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**NAVAL AIR STATION, ALAMEDA
ALAMEDA, CALIFORNIA**

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DATA TRANSMITTAL MEMORANDUM
SITES 4, 5, 8, 10A, 12, AND 14**

**FINAL
VOLUME 1 OF 2**

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ERRATA SHEET
Remedial Investigation/Feasibility Study Data Transmittal Memorandum,
Sites 4, 5, 8, 10A, 12, and 14

The purpose of this errata sheet is to identify areas where the text in the Remedial Investigation/Feasibility Study Data Transmittal Memorandum, Sites 4, 5, 8, 10A, 12, and 14 dated January 30, 1995 was erroneous. The document will not be published again in full, so this errata sheet can be kept with the document to reflect necessary corrections. The following text corrections should be noted.

1. Page 1-1, Section 1.1 Objectives of the Data Transmittal Memorandum, paragraph 1. The third sentence currently reads, "The memorandum presents a detailed remedial investigation (RI) interpretation of the data or assessment of human health or environmental risks." The sentence should read, "The memorandum presents results of recently collected soil, groundwater, and storm drain sediment samples, but does not present a detailed interpretation of these data for risk assessment purposes."

**NAVAL AIR STATION, ALAMEDA
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DATA TRANSMITTAL MEMORANDUM
CTO 0260 - SITES 4, 5, 8, 10A, 12 AND 14**

CONTENTS

<u>Section</u>	<u>Page</u>
LIST OF ABBREVIATIONS AND ACRONYMS	ix
EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION	1-1
1.1 OBJECTIVES OF THE DATA TRANSMITTAL MEMORANDUM ..	1-1
1.2 DOCUMENT ORGANIZATION	1-2
2.0 BACKGROUND	2-1
2.1 PHYSIOGRAPHIC AND HYDROGEOLOGIC SETTING OF NAS ALAMEDA	2-1
2.2 SITE DESCRIPTIONS AND INVESTIGATION BACKGROUND ...	2-3
2.2.1 Site 4	2-3
2.2.2 Site 5	2-5
2.2.3 Site 8	2-7
2.2.4 Site 10A	2-8
2.2.5 Site 12	2-9
2.2.6 Site 14	2-10
3.0 FIELD WORK ACCOMPLISHED	3-1
3.1 CPT/HYDROPUNCH INVESTIGATION	3-1
3.2 SURFACE SOIL SAMPLING	3-4
3.3 SHALLOW SOIL BORING AND SHALLOW MONITORING WELL INSTALLATION	3-5
3.4 REFERENCE BORINGS	3-9
3.5 DEEP WELL INSTALLATION	3-11
3.6 NON-POINT SOURCE SAMPLING	3-13
3.7 GROUNDWATER MEASUREMENT AND SAMPLING	3-14
3.8 SITE SURVEYING	3-15
4.0 INVESTIGATION RESULTS	4-1
4.1 REGIONAL LITHOLOGIC FINDINGS	4-1

CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
4.2 SOIL ANALYTICAL RESULTS	4-12
4.2.1 Site 4	4-23
4.2.2 Site 5	4-6
4.2.3 Site 8	4-7
4.2.4 Site 14	4-8
4.3 REGIONAL GROUNDWATER FLOW FINDINGS	4-9
4.3.1 First Water-Bearing Zone	4-10
4.3.2 Second Water-Bearing Zone	4-12
4.4 GROUNDWATER ANALYTICAL RESULTS	4-13
4.4.1 Site 4	4-14
4.4.2 Site 5	4-16
4.4.3 Site 8	4-19
4.4.4 Site 10A	4-20
4.4.5 Site 12	4-22
4.4.6 Site 14	4-24
4.5 NON-POINT SOURCE SAMPLING RESULTS	4-25
4.5.1 Site 4	4-26
4.5.2 Site 5	4-27
4.5.3 Site 8	4-29
4.5.4 Site 10A	4-30
4.5.5 Site 12	4-31
4.5.6 Site 14	4-32
5.0 DATA QUALITY	5-1
5.1 ANALYTICAL PROGRAM	5-1
5.2 DATA VALIDATION	5-2
5.3 PARCC	5-4
5.3.1 Precision	5-4
5.3.2 Accuracy	5-4
5.3.3 Representativeness	5-4
5.3.4 Completeness	5-5
5.3.5 Comparability	5-5

CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
6.0 CONCLUSIONS AND RECOMMENDATIONS	6-1
6.1 SUMMARY OF BACKGROUND AND FIELD ACTIVITIES	6-1
6.2 SUMMARY OF LITHOLOGIC FINDINGS	6-2
6.3 SUMMARY OF ANALYTICAL FINDINGS	6-2
6.4 RECOMMENDATIONS	6-6
REFERENCES	R-1

ATTACHMENTS

- 1 CPT LITHOLOGIC PRINTOUTS
- 2 BORING LOGS
- 3 SOIL AND GROUNDWATER DETECTION TABLES
- 4 DISCUSSION OF STLC VALUES AND COMPARISON
- 5 LOCATIONS OF MONITORING WELLS UTILIZED FOR STATISTICAL TOLERANCE INTERVAL

FIGURES

<u>Figure No.</u>		<u>Follows Page</u>
2-1	LOCATION MAP	2-11
2-2	IDEALIZED STRATIGRAPHIC COLUMN FOR ALAMEDA AREA	2-11
2-3	RI SITES LOCATION MAP	2-11
3-1	SITE 4 SAMPLE LOCATIONS	3-15
3-2	SITES 5, 8, 10A, 12 SAMPLE LOCATIONS	3-15
3-3	SITE 14 SAMPLE LOCATIONS	3-15
4-1	SITE 4 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SOIL	4-32
4-2	SITE 4 - 1994 ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANIC COMPOUNDS AND CYANIDE IN SOIL	4-32
4-3	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN SOIL	4-32
4-4	SITES 5 AND 8 - 1994 ANALYTICAL RESULTS FOR VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS IN SOIL	4-32
4-5	SITE 8 - 1994 ANALYTICAL RESULTS FOR PCB COMPOUNDS AND PESTICIDES IN SOIL	4-32
4-6	SITE 14 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SOIL	4-32
4-7	SITE 14 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN SOIL	4-32
4-8	SITE 14 - 1994 ANALYTICAL RESULTS FOR PCB COMPOUNDS, PESTICIDES, AND DIOXIN IN SOIL	4-32
4-9	SITE 4 - GROUNDWATER CONTOURS SHALLOW ZONE	4-32
4-10	SITES 5, 8, 10A, 12 - GROUNDWATER CONTOURS FIRST WATER-BEARING ZONE	4-32
4-11	SITE 14 - GROUNDWATER CONTOURS FIRST WATER-BEARING ZONE ..	4-32

FIGURES
(Continued)

Figure No.		Follows Page
4-12	SITES 5, 8, 10A, 12 - GROUNDWATER CONTOURS SECOND WATER-BEARING ZONE	4-32
4-13	SITE 4 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SHALLOW ZONE	4-32
4-14	SITE 4 - 1994 ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SHALLOW ZONE	4-32
4-15	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS AND CYANIDE IN GROUNDWATER SHALLOW ZONE	4-32
4-16	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN GROUNDWATER SHALLOW ZONE	4-32
4-17	SITE 4 - TOTAL DISSOLVED SOLIDS CONTOURS IN GROUNDWATER SHALLOW ZONE	4-32
4-18	SITE 4 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER DEEP ZONE	4-32
4-19	SITE 4 - 1994 ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANIC COMPOUNDS IN GROUNDWATER DEEP ZONE	4-32
4-20	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS AND CYANIDE IN GROUNDWATER DEEP ZONE	4-32
4-21	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN GROUNDWATER DEEP ZONE	4-32
4-22	SITE 4 - 1994 ANALYTICAL RESULTS FOR TOTAL DISSOLVED SOLIDS IN GROUNDWATER DEEP ZONE	4-32
4-23	SITE 5 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-24	SITES 5, 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANIC COMPOUNDS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32

FIGURES
(Continued)

Figure No.		Follows Page
4-25	SITE 5 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS AND CYANIDE IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-26	SITE 5, 8, 10A, 12 - TOTAL DISSOLVED SOLIDS CONTOURS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-27	SITE 5 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SECOND WATER-BEARING ZONE . . .	4-32
4-28	SITES 5, 8 - 1994 ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-29	SITE 5 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS AND CYANIDE IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-30	SITES 5, 8, 10A, 12 - TOTAL DISSOLVED SOLIDS CONTOURS IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-31	SITES 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-32	SITES 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-33	SITES 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SECOND WATER-BEARING ZONE . . .	4-32
4-34	SITES 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-35	SITE 12 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-36	SITE 14 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-37	SITE 14 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32

FIGURES
(Continued)

Figure No.		Follows Page
4-38	SITE 14 - 1994 ANALYTICAL RESULTS FOR TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE AND PURGEABLE IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-39	SITE 14 - TOTAL DISSOLVED SOLIDS CONTOURS IN GROUNDWATER FIRST WATER-BEARING ZONE	4-32
4-40	SITE 14 - 1994 ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER SECOND WATER-BEARING ZONE ...	4-32
4-41	SITE 14 - 1994 ANALYTICAL RESULTS FOR TOTAL METALS IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-42	SITE 14 - 1994 ANALYTICAL RESULTS FOR TOTAL DISSOLVED SOLIDS IN GROUNDWATER SECOND WATER-BEARING ZONE	4-32
4-43	SITE 4 - 1994 ANALYTICAL RESULTS FOR NON-POINT SOURCE UTILITY SAMPLES	4-32
4-44	SITES 5, 8, 10A, 12 - 1994 ANALYTICAL RESULTS FOR NON-POINT SOURCE UTILITY SAMPLES	4-32
4-45	SITE 14 - 1994 ANALYTICAL RESULTS FOR NON-POINT SOURCE UTILITY SAMPLES	4-32

TABLES

<u>Table No.</u>		<u>Follows Page</u>
3-1	CPT AND HYDROPUNCH DEPTHS	3-15
3-2	SUMMARY OF ANALYSES PERFORMED ON HYDROPUNCH GROUNDWATER SAMPLES	3-15
3-3	SUMMARY ANALYSES PERFORMED ON SURFACE SOIL SAMPLES	3-15
3-4	SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL BORING AND GROUNDWATER SAMPLES	3-15
3-5	DEEP MONITORING WELL CONSTRUCTION DETAIL	3-15
3-6	SUMMARY OF ANALYSES PERFORMED ON DEEP MONITORING WELL SOIL AND GROUNDWATER SAMPLES	3-15
3-7	SUMMARY OF NON-POINT SOURCE SAMPLES	3-15
3-8	DEPTH TO GROUNDWATER MEASUREMENTS	3-15
4-1	STATISTICAL ANALYSIS OF METALS RESULTS FOR SOIL SAMPLES . . .	4-32
4-2	METALS IN SOIL EXCEEDING 95 PERCENT/95 PERCENT STI OR 10 TIMES STLC AT SITE 4	4-32
4-3	METALS IN SOIL EXCEEDING 95 PERCENT/95 PERCENT STI OR 10 TIMES STLC AT SITE 8	4-32
4-4	STATISTICAL ANALYSIS OF METALS RESULTS FOR GROUNDWATER SAMPLES	4-32
4-5	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 4	4-32
4-6	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 5	4-32
4-7	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 8	4-32
4-8	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 10A	4-32

TABLES
(Continued)

<u>Table</u> <u>No.</u>		<u>Follows</u> <u>Page</u>
4-9	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 12	4-32
4-10	METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 14	4-32
5-1	PERCENTAGE OF QUALIFIED DATA - FIRST QUARTER GROUNDWATER SAMPLES AND HYDROPUNCH SAMPLES	5-6
5-2	PERCENTAGE OF QUALIFIED DATA - SOIL SAMPLES	5-6

LIST OF ABBREVIATIONS AND ACRONYMS

DRAFT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DATA TRANSMITTAL MEMORANDUM
SITES 4, 5, 8, 10A, 12 AND 14

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EXECUTIVE SUMMARY

PRC Environmental Management Inc. (PRC) and its team subcontractor, Montgomery Watson (the PRC team), conducted field sampling to collect additional soil and groundwater data at Naval Air Station (NAS) Alameda, Installation Restoration Program (IRP) Sites 4, 5, 8, 10A, 12, and 14 for remedial investigation/feasibility study (RI/FS) evaluation. The purpose of this data transmittal memorandum is to summarize the field activities and the first quarter of groundwater sampling (one of the four quarters planned) conducted under CTO 0260. This memorandum is not intended to present detailed data evaluation and interpretation, which will be presented in future RI reports for these sites.

The PRC team conducted field activities at six sites at NAS Alameda, pursuant to the "Follow On Field Sampling Plan, RI/FS Phases 2B and 3" (Phases 2B and 3 FSP), dated October 14, 1994 (PRC and Montgomery Watson 1994), which was prepared based on previous data collected at these sites and the quality assurance project plan (QAPP) (PRC and Montgomery Watson 1993c). Field activities were performed in conformance with the Phases 2B and 3 FSP with the exception of four sampling locations which were not obtainable, due to site inaccessibility or refusal encountered during subsurface penetration. Field activities at each site included cone penetrometer testing (CPT) and HydroPunch sampling, non-point source (NPS) sampling, shallow soil sampling, surface soil sampling, shallow soil boring and monitoring well installation, deep monitoring well installation and first quarter groundwater sampling.

The lithologic findings at Sites 5, 8, 10A, 12, and 14 appear consistent with previous studies which indicate a first water-bearing zone separated from a lower second water-bearing zone by a less permeable Bay Mud unit. The more inland geology near Site 4 indicated the absence of a Bay Mud unit, making the second water-bearing zone in direct hydraulic connection with the first water-bearing zone.

Results of the first quarter groundwater monitoring indicated that groundwater flow directions in the first water-bearing zone appear to be influenced by utilities or utility trenches. The influence has resulted in variable flow directions at Sites 5, 8, 10A, and 12. Groundwater monitoring wells were installed in the second water-bearing zone as part of this investigation. Groundwater flow direction in

the second water-bearing zone was measured, with movement southward at Sites 5, 8, 10A, and 12. Groundwater flow direction in the second water-bearing zone at Sites 4 and 14 will be determined later from deep well measurements which were gathered in October 1994.

Analytical results were generally consistent with previous contaminants detected and concentration ranges in the first water-bearing zone and soils. All six sites appear to be adequately characterized for potential chemicals of interest in soil for the RI/FS evaluation. Uncertainties exist with the extent and magnitude of metals at a single soil sample location at Sites 4 and 8, and at Site 14, where dioxin was detected in surface soils. If a health or environmental risk exists at these sites, additional sampling will be evaluated.

As part of this study, groundwater quality in the second water-bearing zone was evaluated for the first time and is believed to be characterized. Three additional quarterly sampling events are also scheduled for the wells in the second water-bearing zone.

The groundwater in the first water-bearing zone is believed to be adequately characterized at Sites 8, 10A, 12, and 14. However, based on the new groundwater data, additional work is recommended at Sites 4 and 5 to better characterize the extent of chemicals of interest.

1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC) received contract task order (CTO) No. 0260 from the Department of the Navy, Western Division, Naval Facilities Engineering Command (WESTDIV), under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62474-88-D-5086 on November 22, 1993. The Navy statement of work for this CTO calls for PRC to implement the "Follow-On Field Sampling Plan, Remedial Investigation/Feasibility Study, Phases 2B and 3" (PRC and Montgomery Watson, 1994) for the Installation Restoration Program (IRP) Sites 4, 5, 8, 10A, 12, and 14 at the Naval Air Station (NAS) Alameda, California.

PRC and its CLEAN team subcontractor, Montgomery Watson (hereafter referred to collectively as the PRC team) began the CTO 0260 field investigation in January 1994. The field investigation consisted of drilling, soil sampling, non-point source sampling, well installation, cone penetrometer testing (CPT), and HydroPunch II® (HydroPunch) sampling. Additionally, CTO 0260 includes four quarters of groundwater sampling.

1.1 OBJECTIVES OF THE DATA TRANSMITTAL MEMORANDUM

The purpose of the data transmittal memorandum is to summarize the activities and results of the field investigation and the first quarter of groundwater sampling. The memorandum provides timely and pertinent information to guide future IRP work at NAS Alameda, if required. The memorandum presents a detailed remedial investigation (RI) interpretation of the data or assessment of human health or environmental risks. The scope of work also includes a brief comparison of recent findings with previous investigations at the CTO 0260 sites, and addresses whether sufficient data are currently available to complete the remedial investigation/feasibility study (RI/FS) evaluation at each site. The comprehensive RI report, which will include an evaluation of fate and transport of chemicals and a risk assessment, will be completed after the fourth quarter of groundwater sampling is conducted in March 1995, and should be available in the fall of 1996.

1.2

DOCUMENT ORGANIZATION

This data transmittal memorandum includes a brief presentation of the background information for each of the CTO 0260 sites followed by the discussions of the field activities and the results of the follow-on field work. This memorandum is organized as follows:

- Section 2.0 - Background
- Section 3.0 - Field Work Accomplished
- Section 4.0 - Investigation Results
- Section 5.0 - Data Quality
- Section 6.0 - Conclusions and Recommendations

2.0 BACKGROUND

Environmental investigations began at NAS Alameda under the Naval Assessment and Control of Installation Pollutants (NACIP) program in 1983 (Ecology and Environment 1983). The RI/FS process began in 1988, prior to the CLEAN program, with the preparation of the RI/FS work plan documents. The initial RI field work was completed at these six sites (4, 5, 8, 10A, 12, and 14) primarily under the RI/FS Phases 2B and 3 work in 1992. Based on the results of the initial field investigations, additional investigation and sampling was recommended at all six sites and is described in the Phases 2B and 3 follow-on field sampling plan (FSP) (PRC and Montgomery Watson 1994).

This section presents a brief description of the hydrogeologic setting of NAS Alameda and a brief summary of the background information for each of the site sites. More detailed site descriptions can be found in the final data summary report, RI/FS Phases 2B and 3 (PRC and Montgomery Watson 1992b).

2.1 PHYSIOGRAPHIC AND HYDROGEOLOGIC SETTING OF NAS ALAMEDA

NAS Alameda, as shown in Figure 2-1, is located on the western end of Alameda Island, primarily in Alameda County, California. Alameda Island is located within the San Francisco Bay basin, which lies within the Coast Range physiographic province of California. The air station is bounded on the north by the Oakland Inner Harbor, on the west by the San Francisco Bay, and on the south by the San Francisco Bay and the Seaplane Lagoon.

Much of the land now occupied by the air station once covered by the waters of San Francisco Bay and most of the land not covered by the bay was occupied by tidal flats. The tidal flats and subtidal deposits are considered a portion of the Holocene Bay Mud stratigraphic unit (also called the Young Bay Mud). Figure 2-2 presents a stratigraphic column for the NAS Alameda area with a comparison to stratigraphic nomenclature previously applied by Trask and Rolston (1951). Within the air station boundaries, the Holocene Bay Mud is overlain by hydraulically placed fill material which comprises the uppermost water-bearing zone. The fill ranges in thickness from 0 to 30 feet and underlies most of NAS Alameda, with the exception of the eastern portion of the base where there is no definable Holocene Bay Mud unit. The Holocene Bay Mud is underlain by Holocene and late Pleistocene alluvial and eolian deposits. These deposits are roughly equivalent to the Merritt Sand

unit described by Trask and Rolston (1951). The Merritt Sand is underlain by Late Pleistocene estuarine deposits which consist of dark greenish-gray silty clay in the vicinity of NAS Alameda and is considered an aquitard in this area.

Different authors have used different stratigraphic names and slightly different definitions when referring to the Late Pleistocene estuarine deposits. Trask and Rolston (1951) used the term San Antonio Formation for sediments which are primarily composed of estuarine clays. However, Trask and Rolston's San Antonio Formation contains at least one relatively thick and laterally extensive sand bed. In contrast to Trask and Rolston, Sloan (1992) called the late Pleistocene estuarine deposits the Yerba Buena Mud. Sloan restricted the name Yerba Buena Mud to sediments composed of clay, and as a result the Yerba Buena Mud can be reasonably expected to act as an aquitard. Although the stratigraphic relationships are not entirely clear, Sloan (1981) believes that most of the San Antonio Formation is correlative with the Yerba Buena Mud. For the purpose of this data transmittal memorandum, the late Pleistocene estuarine deposits are referred to as the Yerba Buena Mud because the Yerba Buena Mud, being composed of clay, has more predictable hydrogeologic properties, and can be reasonably expected to act as an aquitard.

The hydrological units of primary importance to the RI/FS investigation are the Merritt Sand, the Holocene Bay Mud, and the overlying artificial fill material. These units make up the shallow aquifer. The shallow aquifer has two primary water-bearing zones; one above the Holocene Bay Mud in the fill material (referred as the "first water-bearing zone") and the second below the Holocene Bay Mud in the Merritt Sand (referred as the "second water-bearing zone"). The Holocene Bay Mud has been found to be siltier and sandier in the western portion of the base, and discontinuous in the southeastern portion of the base. In the southeastern portion of the base, all units above the Yerba Buena Mud are considered to be in hydraulic connection (PRC 1991). The alluvial portion of undifferentiated Pleistocene deposits, which underlay the Yerba Buena Mud, comprise a second, deeper aquifer. Further geologic interpretation will be conducted during the RI/FS, when all of the data is available.

A limited evaluation of water levels in the first water-bearing zone was performed during previous investigations at the six CTO 0260 sites. During a tidal influence study in 1992, a tidal influence was noted at Site 14 and an average southwest groundwater flow direction was identified. No tidal

influence was identified at Sites 4, 5, 8, 10A, and 12. Based on limited water level measurements performed previously at these sites, a preliminary assessment of groundwater flow in the first water-bearing zone indicates that flow directions vary between sites; however, adequate data are not yet available to define flow directions. Four quarters of water level monitoring, the first of which is described here, will provide adequate data for gradient characterization. The site characterization presented in the comprehensive RI report will include all data gathered during the IRP investigations.

2.2 SITE DESCRIPTIONS AND INVESTIGATION BACKGROUND

Figure 2-3 shows the location of each of the six CTO 0260 sites. As noted previously, initial RI/FS investigations have been performed at each site. Detailed descriptions of the sites, their hydrogeologic setting, and their past and current activities are presented in several documents including the Phases 2B and 3 data summary report (DSR) (PRC and James M. Montgomery Engineers, Inc. [JMM] 1992b), and the Phases 2B and 3 follow-on FSP (PRC and Montgomery Watson 1994). The following subsections present a brief description of each site and list the previous investigations conducted at the site as well as a summary of the findings.

2.2.1 Site 4

Site Description. Site 4 consists of Building 360, which is located near the eastern perimeter of the base. The depth to groundwater at Site 4 is approximately 5 feet below ground surface (bgs). Building 360 is currently used as an aircraft engine repair and testing facility. Machine shops, cleaning and painting shops, and parts assembly areas are still in use. Building 360 also contains a former plating shop, which was dismantled and removed in 1991. Processes in the former plating shop included paint stripping by blasting, metal stripping, etching and metal plating. Paint spray booths that were operated in the plating shop have also been removed. Chemicals used in the cleaning shop historically included a mixture containing 55 percent tetrachloroethene (PCE); several other mixtures have been used that contain dichlorobenzene, methylene chloride, toluene, and 30 to 70 percent solutions of sodium hydroxide.

Prior to 1975, plating wastes were discharged to the Seaplane Lagoon via the industrial waste sewer system. After 1975, the plating wastes were separated into a cyanide waste stream and a chromium

waste stream; the cyanide waste stream was discharged directly to the industrial sewer, and the chromium waste stream was routed through an industrial waste treatment facility to the west of Building 360 before being discharged into the industrial sewer. The industrial sewer now discharges to the East Bay Municipal Utility District (EBMUD) sewer treatment facility in Oakland, California.

Previous Investigations. The following environmental studies were conducted at Site 4 prior to the Phases 2B and 3 follow-on investigation.

- In 1981 and 1982, Environmental Research Group, Inc. (ERG) collected surface soil samples beneath the plating shop for analytical testing (ERG 1982). The results of the ERG study are summarized in the Phases 2B and 3 DSR (PRC and JMM 1992b).
- In 1989, Canonie installed four monitoring wells around the perimeter of Building 360 and collected soil and groundwater samples. The results of the Canonie investigation are presented in the Phases 1 and 2A DSR (PRC and Montgomery Watson 1993b); a separate document was not produced by Canonie.
- In 1991 and 1992, the PRC team collected 20 surface soil samples, 9 grab groundwater samples, and a total of 14 wipe and scrape samples from the plating shop. The results of the 1991 and 1992 investigations are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b) and the DSR for the background and tidal influence studies and additional work at Sites 4 and 5 (PRC and JMM 1992a).

Findings from Previous Investigations

- Results from shallow soil samples collected outside Building 360 indicated the presence of chlorinated solvents and gasoline constituents to depths of 15.5 feet bgs generally north, east, and west of the building. No chlorinated solvents were detected south of the building. No analyses were performed for petroleum hydrocarbons in soil.
- Shallow soil samples from outside Building 360 indicated an elevated lead concentration (above 10 times the soluble threshold limit concentration [STLC]) at 2.5 feet bgs on the east side of Building 360. The soil beneath the plating shop contained elevated concentrations (above 10 times the STLC) of lead and nickel. Chromium was detected at concentrations as high as two times the STLC.
- Cyanide was detected at depths ranging from 1 foot to 12.5 feet bgs on the east, southeast, and west sides of Building 360. Cyanide was also detected in 8 of 19 surface soil sample locations beneath the plating shop.

- Chlorinated solvents have been detected in shallow groundwater wells on the west, north, and east sides of Building 360 as well as beneath the plating shop.
- Hexavalent chromium was detected in shallow grab groundwater samples beneath the plating shop at potentially elevated concentrations as high as 1,020 micrograms per liter ($\mu\text{g/L}$).

2.2.2 Site 5

Site Description. Site 5 consists of Building 5 and is located between First and Second Streets and Avenues C and F. The depth to groundwater at Site 5 is approximately 6 feet bgs. The site has been in operation since 1942. The building is the largest on base and covers approximately 18.5 acres. Building 5 is currently used for manufacturing, cleaning and reworking metal parts, and painting operations; a wastewater treatment area and a battery storage area are also located on the site. Building 5 formerly housed shops used for cleaning, reworking, and manufacturing metal parts, tool maintenance, plating, and painting operations. The site also contained a hazardous waste storage area which was closed in 1988. The hazardous waste storage area is currently used to store drummed hydraulic fluid and lubricating oils. The main plating shop was closed in June 1990 after which it was inactive with the exception of two rinse tanks used for parts that have since been plated in the selective plating shop. The selective plating shop has been abandoned since October 1993.

Processes in the plating shop included degreasing, caustic and acid etching, metal stripping and cleaning, and chrome, nickel, silver, cadmium, and copper plating. Both cyanide and chromium processes were used in the plating shop. The wastewater treatment area contains sumps that were used to store cyanide- and chrome-containing wastewaters from the plating shop prior to pretreatment. The cyanide wastewater stream was treated in a cyanide destruction unit. This area currently serves the cleaning shop and the conversion coating area and formerly served the plating shop. The former hazardous waste storage area housed drummed spent solvents, waste paint, and waste oil.

Previous Investigations. The following environmental studies were conducted at Site 5 prior to the Phases 2B and 3 follow-on investigation.

- In 1991, the PRC team conducted the initial RI/FS investigation which included a surface geophysical survey, surface soil sampling, geotechnical analyses, and 13 soil

borings, five of which were converted to monitoring wells. The results of the 1991 investigation are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b)

- In 1992 and 1993, the PRC team performed additional investigations in and around five areas at Site 5: the plating shop, the selective plating shop, the wastewater treatment area, the former hazardous waste storage area, and the battery storage area. These investigations included soil borings and soil sampling, grab groundwater sampling, wipe or scrape sampling in the plating shop, and monitoring well installation and groundwater sampling. The results of the 1992 and 1993 investigations are presented in the DSR for the background and tidal influence studies and additional work at Sites 4 and 5 (PRC and JMM 1992a) and the additional site investigation, Site 5 plating shop report (PRC 1994).

Findings From Previous Investigations

- Results from shallow soil samples from beneath the plating shop indicated the presence of 1,1,1-trichloroethane (1,1,1-TCA) at a depth of 5 feet and chloroethane in one sample from 18 feet bgs. A single soil sample collected from beneath the selective plating shop did not indicate the presence of volatile organic compounds (VOC). PCE and vinyl chloride were detected in samples from the former hazardous waste storage area at depths of 0 and 10 feet bgs, respectively.
- Shallow soil samples from beneath selected areas in and around Building 5 indicated elevated concentrations (above 10 times the STLC) of cadmium beneath the plating shop (0 to 18 feet bgs) and selective plating shop (surface soil), and lead beneath the plating shop (surface soil) and the battery storage area (2.5 feet bgs). Cyanide was detected in surface soils beneath the plating shop.
- Surface soil from outside Building 5 contained elevated concentrations of lead near the northeast corner of the building, north of the battery storage area.
- Common industrial solvents and their transformation products including 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethene (1,2-DCE), 1,1-dichloroethylene (1,1-DCE), trichloroethene (TCE), and 1,1,1-TCA were detected in shallow groundwater wells on the east, south, and west sides of Building 5. Gasoline constituents were detected on the south side of Building 5. At the same location, cyanide and elevated concentrations of nickel were detected in the groundwater. Cyanide was also found in groundwater beneath the plating shop, the wastewater treatment area, and the former hazardous waste storage area.
- Common industrial solvents and their transformation products were detected in groundwater beneath Building 5; 1,1,1-TCA and 1,1-DCA were detected in shallow grab groundwater samples from beneath the plating shop. Similar solvents as well as gasoline constituents were detected in shallow grab groundwater samples collected

from the wastewater treatment area, the former hazardous storage area, and the battery storage area.

- Chromium, cadmium, lead, barium, beryllium, and nickel were detected in shallow grab groundwater samples beneath the plating shop at potentially elevated concentrations. Chromium, beryllium, lead, and nickel were also detected in groundwater beneath the wastewater treatment area.

2.2.3 Site 8

Site Description. Site 8 consists of Building 114, which is located on Third Street between Avenues C and D. The depth to groundwater at Site 8 is approximately 6 feet bgs. Building 114 served as the Navy Public Works Center (PWC) maintenance and storage shop, office equipment storage, appliance repair, and administrative office, and has been used as the center for weed and pest control on the base. PWC also stored material and rinsed equipment in the yard of Building 114. Site 8 currently houses Navy and PWC administrative offices in the western half of Building 114 and PWC shops in the eastern half.

Pesticides stored at Site 8 included chlordane, lindane, DDT, malathion, and diazanon. Herbicides stored there included Telvar, Chlorvar, 2,4-D, Roundup, Princep, and Krovar I. Activities at Site 8 also included woodworking, painting, and steam cleaning. Wastewater generated from these activities was discharged directly to the storm drains. A separator pit located in the western corner of the courtyard separated sludges and floating material from the wastewater stream; however, this system operated inadequately, sometimes allowing sludge and floating material to remain.

Previous Investigations. In 1991, the PRC team performed the initial RI/FS investigation at Site 8 to assess if surface spills or leaks from the industrial sewer line had introduced contamination into surface or subsurface soils. The field investigation included 12 soil borings, 5 of which were converted to shallow monitoring wells, soil and groundwater sampling, and in-situ permeability testing. Details of this investigation are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b).

Findings From Previous Investigations

- Past activities conducted at Site 8 appear to have impacted only soil. Analytical results from soil borings throughout the site indicate the presence of semivolatile organic compounds (SVOC) (primarily polycyclic aromatic hydrocarbons) to depths of 14 feet bgs. Polychlorinated biphenyls (PCB), pesticides, and herbicides were also detected in surface soils throughout the site. The herbicides MCPA and MCPP were present at depths up to 14 feet bgs. The greatest concentrations were found in surface soil from a boring in the northeast corner of the site.
- Low levels of gasoline constituents were detected in shallow groundwater in four of the five monitoring wells, and a low concentration of 1,2-dichloroethene was detected in shallow groundwater from one monitoring well.

2.2.4 Site 10A

Site Description. Site 10A consists of Building 400, and is located south of Avenue F, between Buildings 11 and 12. The site is approximately 600 feet north of the Seaplane Lagoon and the depth to groundwater is approximately 5 feet bgs. The building has been in operation since the mid-1950s and was used for missile rework operations until 1972. Currently, the building is used for paint stripping, constructing fiberglass aircraft components, and aircraft parts cleaning operations.

Wastes generated at this site include paint sludges, metal shavings, paint strippers, cleaning solvents such as TCE and carbon tetrachloride, testing fluids, miscellaneous waste oils, and oil and grease. Solid waste generated at this facility was disposed of in the West Beach Landfill. Wastewater streams were discharged to the industrial waste sewer system. Used chemicals are currently disposed of by collecting the wastes at one of the five generator accumulation point (GAP) sites in the building.

Previous Investigations. The PRC team performed the initial RI/FS investigation at Site 10A in 1991. The investigation included four soil borings, three of which were converted to shallow monitoring wells, soil and groundwater sampling, and in-situ permeability testing. Details of this investigation are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b).

Findings From Previous Investigations

- Based on the findings of the Phases 2B and 3 investigation, there is little to no impact to soil or groundwater from activities conducted at Site 10A. Analytical results from shallow groundwater samples indicate the presence of VOCs (including 1,1-DCA, 1,2-DCE, 1,2-dichloropropane [1,2-DCP], and TCE) only in the northernmost well. The VOCs detected are likely a result of past activities at Site 5, which is located on the north side of Site 10A. Water levels collected at Sites 5 and 10A in December 1991 indicated that groundwater may flow from portions of Site 5 to Site 10A.

2.2.5 Site 12

Site Description. Site 12 consists of Building 10, the NAS Alameda power plant. It is located north of Avenue F between Second and Third Streets. The depth to groundwater is approximately 6 to 7 feet bgs. Bunker "C" fuel oil and white gas were stored in six underground storage tanks (UST) located on site. The Bunker "C" fuel oil tanks (five tanks) have been closed in place and are filled with sand. The white gas tank, located on the southwest corner of the building, was removed in 1993.

During past operations of the power plant, releases of boiler blowdown water containing caustic soda, phosphate, and sulfide were discharged into the industrial waste sewer. Historically, spills of diesel and petroleum products were documented and staining has been observed on the concrete floor of the building around the base of a diesel generator at the east end of the building. The power plant currently houses seven operating boilers fueled by natural gas used to generate power for NAS Alameda. Diesel fuel is used as a backup for the boilers and is stored in nine aboveground tanks located in a bermed yard south of the building. There is no documented evidence of leaks from these tanks. Activities conducted in the power plant include steam generation and air compression.

Previous Investigations. The PRC team performed the initial RI/FS investigation at Site 12 in 1991. This investigation included 10 soil borings, four of which were converted to shallow monitoring wells, soil and groundwater sampling, and in-situ permeability tests. Details of this investigation are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b).

Findings From Previous Investigations

- Total petroleum hydrocarbons were found in surface soil in concentrations ranging from 31 to 20,500 milligrams per kilogram (mg/kg). The highest concentrations were on the east side of Building 10. Total petroleum hydrocarbons were also found in subsurface soil to depths of 14 feet and maximum concentrations of 156 mg/kg at 11 feet bgs.
- Groundwater results have indicated the presence of 1,2-DCE (1.6 µg/L) in the shallow well located in the northeast corner of the site.

2.2.6 Site 14

Site Description. Site 14 is the fire training area, located on Perimeter Road near Building 443 and approximately 100 feet south of the Oakland Inner Harbor. Groundwater is approximately 5 feet bgs and is tidally influenced.

The site consists of a concrete pad surrounded on three sides by an earthen berm. An aboveground steel tank and a sump presently exist on the pad. Waste fuels from NAS Alameda plane defueling operations were burned in the tank. The site has also been used as a fire extinguisher discharge point and a fire fighting and rescue training area. The area is currently used for fire rescue training.

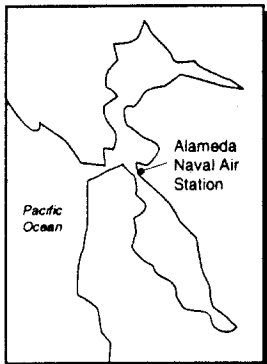
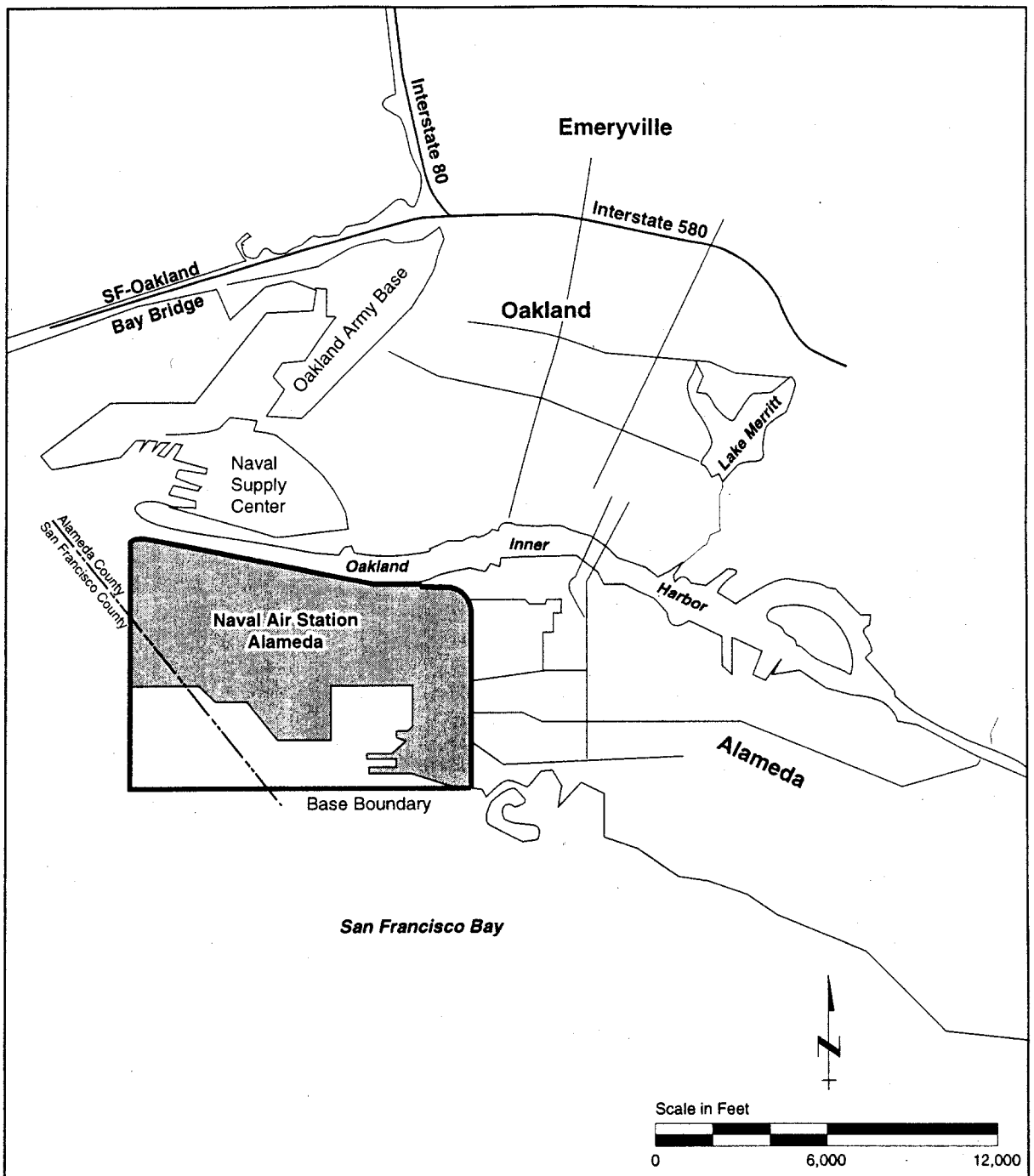
Previous Investigations. The PRC team performed the initial RI/FS investigation at Site 14 in 1991. The investigation included a soil gas survey, three soil borings, all of which were converted to shallow monitoring wells, soil and groundwater sampling, and in-situ permeability testing. Details of this investigation are presented in the Phases 2B and 3 DSR (PRC and JMM 1992b).

Findings From Previous Investigations

- Past fire training activities, as well as other activities, at Site 14 appear to have impacted only soil. Total petroleum hydrocarbons were detected in surface and subsurface soils west, east, and south of the bermed area. Pesticides and PCBs were also found in soils on the west and east sides of the bermed area.
- Dioxins (hepta and octa congeners of chlorinated dibenzo-p-dioxin) were found in the two surface soil samples on the east and west sides of the bermed area.

Heptachlorodibenzofuran was also detected in the surface samples from the east side of the bermed area.

- Only one well has indicated the presence of VOCs in groundwater at Site 14; results from the shallow monitoring well east and downgradient of the bermed area, has indicated the presence of 1,2-DCE (1.8 $\mu\text{g/L}$).



**NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA**

**REGIONAL LOCATION MAP OF
NAS ALAMEDA**

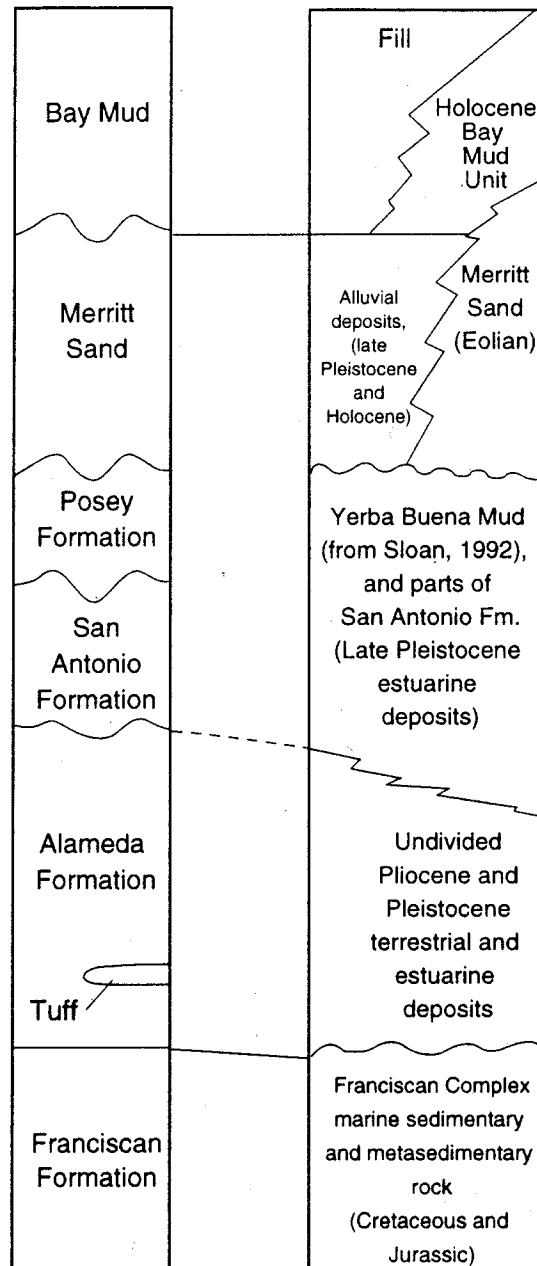
FIGURE 2-1

Source: Modified from CA State Automobile Assoc. map, Oakland/Berkeley/Alameda. Copyright 1980, revised 1989.

Trask and
Rolston (1951)

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San Francisco Bay

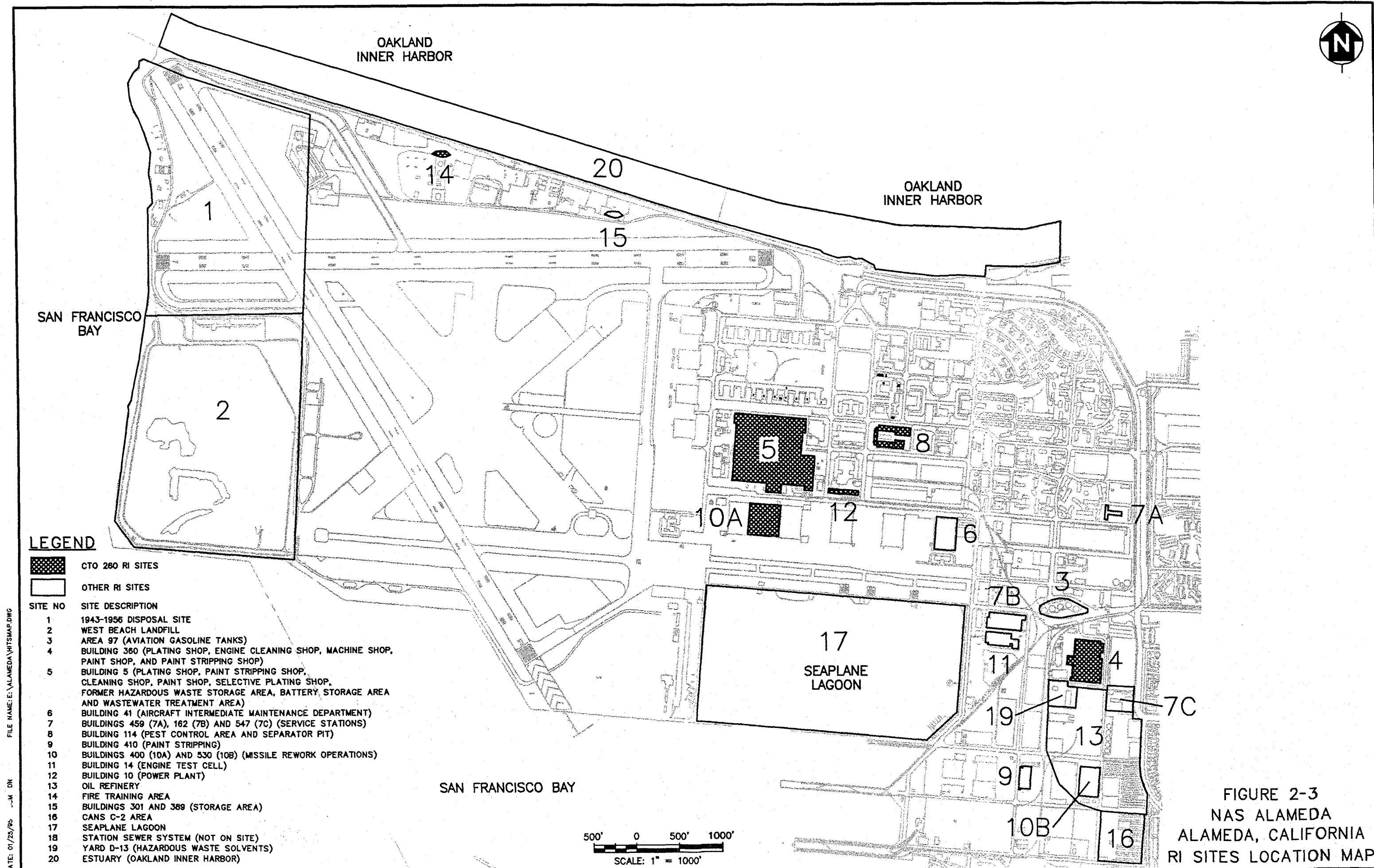


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
**IDEALIZED STRATIGRAPHIC COLUMN
FOR ALAMEDA AREA**

Source: Modified from Phases I and 2A Data Summary Report
(PRC and Montgomery Watson 1993b)

12/94 AL

FIGURE 2-2



FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/25/95
J.M. DN

3.0 FIELD WORK ACCOMPLISHED

The CTO 0260 field activities documented in this data transmittal memorandum were conducted in accordance with two documents: the "Follow-On Field Sampling Plan RI/FS Phases 2B and 3" (PRC and Montgomery Watson 1994) and the quality assurance project plan (QAPP), which is in the "RI/FS Work Plan Addendum" (PRC and Montgomery Watson 1993c). These field activities were intended to provide additional lithologic, chemical, and hydrogeologic information, with the goal of assessing the nature and extent of soil and groundwater contamination for the RI/FS.

Field activities performed included CPT and HydroPunch sampling, non-point source (NPS) sampling and shallow soil sampling, surface soil sampling, shallow soil boring and monitoring well installation, deep monitoring well installation, and quarterly groundwater sampling (including depth-to-water measurements). Field activities were completed in accordance with the Phase 2B and 3 FSP, with the exception of one CPT location that was not completed at Site 4; two HydroPunch samples that were not obtained at Sites 4 and 14; and an NPS sample that was not obtained at Site 8. One soil boring at Site 4 was completed under a later investigation, thus the results were not available for discussion in this data memorandum. The reasons for these changes are discussed in the following subsections. The following subsections describe each field program completed at each site under this CTO.

3.1 CPT/HYDROPUNCH INVESTIGATION

The CPT/HydroPunch program consisted of a CPT combined with HydroPunch sampling at selected locations. The objective of the CPT program was to obtain supplemental deep lithologic information and to evaluate the depth and thickness of the second water-bearing zone for the purpose of selecting HydroPunch sample depths. Because previous investigations primarily involved shallow borings and monitoring wells which typically did not extend beyond 15 feet bgs, the objective of the HydroPunch sampling was to obtain grab groundwater samples in the second water-bearing zone for chemical analysis. The HydroPunch sampling provided an evaluation of the groundwater quality for discrete locations in the second water-bearing zone. The data were used to evaluate whether a deep well would be necessary for future monitoring. No shallow HydroPunch samples were collected for this investigation. In the cases where HydroPunch data indicated that a permanent deep well would be useful, the CPT and HydroPunch data were utilized to optimize the location of the screened interval.

Both the CPT and the HydroPunch programs were performed in accordance with the Phases 2B and 3 follow-on FSP (PRC and Montgomery Watson 1994) with the exceptions described below. The FSP describes the field equipment and procedures used.

The CPT consists of an electric cone which is pushed vertically through the soil at a constant rate while electronically recording soil parameters. The soil parameters include penetration resistance as measured at the cone tip, friction as measured on a friction sleeve, and pore pressure as measured directly behind the cone tip. A continuous profile plotting these three parameters with depth provides a qualitative interpretation on soil lithology.

HydroPunch sampling was used as a screening method for sampling groundwater prior to the selection and installation of the deep monitoring wells. To allow deeper penetration into the dense sands encountered, carbon steel drive rods were used in place of stainless-steel rods. Additional equipment rinsates were collected from the rods, prior to use, for chemical analyses. The results indicated no apparent impact to the sample from the carbon steel rods. The HydroPunch sampler consisted of a 3.5-foot disposable polyvinyl chloride (PVC) screen (which is more durable and functionally equivalent to the polypropylene screen specified in the FSP) and stainless steel drive tip and sampler body. Groundwater was collected with a 3-foot-long, 1/2-inch-diameter Teflon® bailer rather than the stainless steel bailer specified in the FSP. The Teflon® bailer is lighter and easier to maintain and is commonly used for HydroPunch sampling. Rinsate samples were collected from the Teflon® bailer for chemical analysis, as an added quality control measure.

The CPT/HydroPunch program was conducted from January 31, 1994, to February 21, 1994. A total of 25 CPTs were conducted and 24 HydroPunch samples were collected. CPT/HydroPunch locations are shown on Figure 3-1 for Site 4; Figure 3-2 for Sites 5, 8, 10A and 12; and Figure 3-3 for Site 14. One HydroPunch sample (Site 14) could not be collected because of ground saturation after heavy rains. CPT depths ranged from 40 to 80 feet bgs; HydroPunch sample depths ranged from 19 to 80 feet bgs. Table 3-1 summarizes individual depths of each CPT and HydroPunch advancement, and Table 3-2 summarizes the analyses performed on the HydroPunch samples at each site. As noted previously, two objectives of the CPT/HydroPunch program were to evaluate the thickness of the second water-bearing zone and to obtain a groundwater sample from the permeable zone within the second water-bearing zone at each location. The full thickness of the second water-bearing zone

could not be determined at all locations, however, due to restraints inherent in CPT sampling equipment and due to local geologic conditions. The high density of the Merritt Sand combined with the overlying Holocene Bay Mud, which was unsupportive, prevented complete advancement of the CPT rods to the bottom of the second water-bearing zone. In general, penetration into the second water-bearing zone by the CPT ranged from 5 to 15 feet and by the HydroPunch tool was 5 feet. Soil parameters and corresponding lithologic interpretation were recorded approximately every 0.8 feet. CPT lithologic printouts are included as Attachment 1, and correlation with lithologic logs from the deep reference borings is discussed in Section 3.4.

Site 4. A total of three CPT locations were driven at Site 4. The CPT points (CPT-S04-01 through CPT-S04-03) were driven near monitoring wells where elevated levels of VOCs were detected during previous investigations. HydroPunch samples were collected approximately 5 feet away from each CPT location. At Site 4, there is no definable Holocene Bay Mud unit. Therefore, there is no distinction between the first and second water-bearing units, and the HydroPunch sample was collected from the first permeable sand/silty sand unit (20 feet bgs). This permeable unit overlies a relatively impermeable silt or clay layer. A fourth CPT point (CPT-S04-04) was not driven due to subsurface refusal. CPT-S04-04 was intended to be driven on the west side of the building, adjacent to the plating shop; this CPT will be attempted later.

Site 5. A total of seven CPT locations were driven at Site 5. CPT-S05-01 was driven adjacent to monitoring well M05-01, where elevated levels of VOCs were detected in the groundwater in previous studies. CPT-S05-04 was driven adjacent to monitoring well M05-04 where elevated levels of VOCs and SVOCs were previously detected in the groundwater. The remaining five CPT points are located adjacent to existing sewer lines and spaced around the building for lithologic characterization. HydroPunch samples were located approximately 5 feet away from each CPT location, and advanced to the top of the second water-bearing zone underlying the Holocene Bay Mud.

Site 8. A total of four CPT locations were driven at Site 8. CPT-S08-01 was advanced adjacent to monitoring well M-08-02. CPT-S08-02 and CPT-S08-03 were located near the northeast and southeast corners of the building, respectively. CPT-S08-04 was advanced adjacent to monitoring well M08-01, where elevated levels of VOCs were detected. HydroPunch samples were located

approximately 5 feet away from each CPT location, and advanced into the upper portion of the second water-bearing zone underlying the Holocene Bay Mud.

Site 10A. A total of four CPT locations were driven at Site 10A. The four CPT locations were advanced at each corner of the site, primarily for lithologic characterization. HydroPunch samples were located approximately 5 feet away from each CPT location, and advanced into the upper portion of the second water-bearing zone underlying the Holocene Bay Mud.

Site 12. A total of four CPT locations were driven at Site 12. The CPTs are located near the four corners of the site. Three of the CPT/HydroPunch points are also located adjacent to existing shallow monitoring wells in which low levels of VOCs and SVOCs were detected during the previous investigation. CPT-S12-02 is located adjacent to M12-02 at the northeast corner of the building; CPT-S12-03 is located adjacent to M12-04 at the southeast corner of the building; and CPT-S12-04 is located adjacent to M12-03 at the southwestern portion of the building. CPT-S12-01 is located approximately 75 feet north of the center of Building 10, mainly for lithologic characterization. HydroPunch samples were located approximately 5 feet from each CPT location, and advanced into the upper portion of the second water-bearing zone underlying the Holocene Bay Mud.

Site 14. Three CPT locations were driven at Site 14. The CPT sampling points were located on the east, west, and south sides of the site, outside of the bermed area. Two of the CPT locations were within 15 feet of existing shallow monitoring wells. CPT-S14-01 was located adjacent to M14-02 on the west corner of the site; CPT-S14-02 was located about 30 feet southeast of M14-01, where low levels of VOCs and oil and grease were detected; CPT-S14-03 was located adjacent to M14-03 on the south corner of the site. HydroPunch samples were obtained from each CPT location, except CPT-S14-02, in the upper portion of the second water-bearing zone underlying the Holocene Bay Mud. A HydroPunch sample was not obtained from CPT-S14-02 because the location was saturated with surface water and mud, due to heavy rains.

3.2 SURFACE SOIL SAMPLING

Surface soil samples were obtained in accordance with the Phases 2B and 3 FSP (PRC and Montgomery Watson 1994) from Sites 8 and 14 to further characterize the distribution of

contaminants in surface soils. No areas of potential surface-only contaminants were identified in the FSP for follow-on investigation at Sites 4, 5, 10A, and 12. Surface soil samples were collected at a depth of 6 inches bgs. Table 3-3 summarizes the analyses performed on surface soil samples collected.

Site 8. Previous investigations indicated that elevated levels of the polychlorinated biphenyl (PCB) Aroclor-1260 were detected in six surface samples at Site 8. Three surface soil samples (S08-01, S08-02, and S08-03) were collected from Site 8, adjacent to monitoring well M08-04, where pesticides and an elevated level of Aroclor-1260 was detected in the surface soil sample from that boring. The samples were analyzed for PCBs only. Site 8 surface sampling locations are shown on Figure 3-2.

Site 14. Previous investigations detected elevated levels of pesticides and PCBs were detected in surface soil samples at this site. Nine surface soil samples (S14-01 through S14-09) were collected outside of the bermed area to further characterize the extent of soil contamination. Site 14 surface sampling locations are shown on Figure 3-3.

3.3 SHALLOW SOIL BORING AND SHALLOW MONITORING WELL INSTALLATION

The objective of the shallow soil boring and monitoring well installation program was to obtain additional soil data in the vadose zone and groundwater quality and level data in the first water-bearing zone for the RI/FS. Soil samples were collected from 2 to 8 feet bgs, and shallow groundwater samples were collected from the first water-bearing zone, typically from 5 to 15 feet bgs. The rationale for the selection of shallow soil borings and well locations (based on analytical results from earlier investigations) is presented in the Phases 2B and 3 FSP (PRC and Montgomery Watson 1994).

In the Phases 2B and 3 FSP, preliminary groundwater flow directions in the first water-bearing zone were evaluated at each site based on limited water level measurements collected during previous investigations; however, adequate data are not yet available to define flow directions. The installation

of additional wells described in this section, with the four quarters of water level monitoring described in Section 3.7, will provide adequate data for gradient characterization.

Soil borings and monitoring wells were installed in accordance with the Phases 2B and 3 FSP (PRC and Montgomery Watson 1994) with the exceptions noted. Hollow stem auger (HSA) drilling methods were used to advance soil borings and install monitoring wells. Soil borings were typically advanced to a depth of 5.0 feet bgs and soil samples were collected at the surface and at 2.5 and 5 feet bgs. Soil samples were collected using a 2-inch-diameter split-spoon sampler rather than the 2 1/2-inch-diameter sampler specified in the FSP. A 2-inch sampler was easier to drive into the dense sand encountered at NAS Alameda and provided better sample recovery while still providing adequate sample volume. For soil borings that were converted into shallow monitoring wells, a 2-inch well was installed after completion of the soil boring, while the auger flights were still in the ground. This ensured stabilization of the borehole during monitoring well construction. A number 2/12 Monterey Sand filter pack was used instead of number 2/16 because the slightly coarser sand provided more even flow into the well annulus thus preventing potential bridging and allowing a more effective filter pack. The shallow wells were screened from 5 to 15 feet bgs in order to obtain a representative sample from the first water-bearing zone.

Soil sample retrieval and handling was conducted in accordance with the Phases 2B and 3 FSP with the exception of the field screening. For samples where VOCs were suspected, sample portions were placed in a ziplock plastic bag instead of a stainless-steel liner capped at one end with a normal cap and at the other with a slit cap. The sample was then allowed to stand for 10 minutes, rather than 5, to allow for volatilization of VOCs from the soil into the headspace of the bag. The modification allows better volatilization of VOCs from the soil and minimizes the loss of VOC vapor during headspace measurement using an organic vapor analyzer.

Shallow soil boring and shallow monitoring well locations are shown on Figure 3-1 for Site 4; Figure 3-2 for Sites 5, 8, 10A and 12; and Figure 3-3 for Site 14. Handwritten boring logs and shallow well construction logs are included as Attachment 2. Details of the shallow soil boring and monitoring well installation program conducted for these sites are presented below. Table 3-4 lists the chemical analyses that were performed on each shallow soil and groundwater sample.

Site 4

Soil Borings. Four soil borings (B04-21, 22, 23, and 24) were drilled near the four corners outside of the building to assess whether soil has been impacted by petroleum hydrocarbons or other chemicals related to the building's industrial activities. One boring, B04-42, was placed as close as practical to a boring conducted during the 1991 RI/FS investigation, where high levels of cyanide were detected in surface soils. Initial attempts at completing boring B04-41 were unsuccessful due to subsurface obstructions; the boring was completed late and the analytical results were not available for inclusion in this memorandum.

Sixteen shallow soil samples (B04-25 through B04-40) were collected in a grid pattern from within the crawl space under the building. The samples were collected with a hand auger from a depth of 2.5 feet bgs.

Shallow Monitoring Wells. Three monitoring wells were installed at Site 4 (M04-05, M04-06, and M04-07) to be used with the existing shallow monitoring wells (MW360-1 through MW360-4) to further characterize the lateral extent of the VOCs and metals detected in the groundwater beneath the plating shop and around the perimeter of Building 360. Soil samples were collected during the installation of the new monitoring wells and submitted for chemical analysis.

- Well M04-05 was located approximately 80 feet northwest of the plating shop to evaluate the extent of VOCs found in shallow groundwater during the Phases 2B and 3 investigation.
- Well M04-06 was located approximately 200 feet east of well MW360-4 where elevated concentrations of VOCs were detected.
- Well M04-07 was located approximately 250 feet northwest of well M04-05 to evaluate the extent of VOCs found in shallow groundwater under the plating shop during the Phases 2B and 3 investigation.

Site 5

Soil Borings. Three soil borings were advanced at Site 5 (borings B04-14, B04-15, and B05-16). The soil borings were drilled in the vicinity of B05-11 to further evaluate the lateral extent of elevated

VOC concentrations found during the Phase 2B and 3 investigation. Boring B05-16 was converted to a groundwater monitoring well (M05-07).

Shallow Monitoring Wells. Five shallow monitoring wells (M05-06, M05-07, M05-08, M05-09, and M05-10) were installed at Site 5 to further characterize the VOC and metals concentrations in the shallow groundwater aquifer.

- Well M05-06 was located west of Building 5 to evaluate a potential off-site source for the VOCs detected in well M05-02. Well M05-06's location near the industrial waste sewer system pump station in Building 614 allows assessing whether the pump station is a potential source of VOCs found in the groundwater.
- Well M05-07 was located in the vicinity of soil borings B05-11 and B05-10, where elevated concentrations of VOCs were detected in the soil.
- Well M05-08 was located near borings B05-11 and B05-10, and well M05-04, where the highest VOC concentrations were detected in soil and groundwater.
- Well M05-09 was located on the north side of Building 5 to evaluate the northern extent of VOCs in groundwater.
- Well M05-10 was located inside of Building 5, in the vicinity of the plating shop, to assess the potential for the plating shop as a source for VOCs in groundwater.

Site 8

Soil Borings. Two shallow borings were installed at Site 8 that were converted to shallow monitoring wells M08-06 and M08-07. Soil samples were collected during the installation of monitoring wells.

Shallow Monitoring Wells. Based on previous studies, VOCs and SVOCs were detected in the first water-bearing zone at this site. Two shallow monitoring wells were installed to further characterize VOCs, SVOCs, and metals in the first water-bearing zone.

- Well M08-06 was located northwest of well M08-05, near the southeast corner of the north wing of Building 114, to assess the lateral extent of VOCs and elevated metals previously detected in well M08-05.

- Well M08-07 was located southwest of well M08-01 to investigate the potential for an off-site source of the VOCs detected in well M08-01.

Sites 10A and 12

No soil borings or shallow monitoring wells were proposed for these two sites.

Site 14

Soil Borings. Eleven soil borings (B14-04 through B14-14) were installed inside the berm area and through the berm at Site 14 to assess the presence of VOCs detected in soil gas during the previous (1991) phase of work. Three of the boring locations (B14-06, B14-11, and B14-12) were located as closely as possible to the three highest soil gas locations. The remaining eight borings were distributed throughout the area where VOCs were detected in soil gas.

Shallow Monitoring Wells. Based on the results of the Phases 2B and 3 investigation, no additional shallow monitoring wells were installed at Site 14.

3.4 REFERENCE BORINGS

Since CPT data is an electronic representation of lithologic conditions, site-specific lithologic boring logs are necessary to provide a cross reference for interpreting the CPT data. One reference boring was installed at each site to correlate with CPT data. Reference boring locations were adjacent to those CPT points that displayed the most vertical heterogeneity or that penetrated to a greater depth than surrounding CPT points. A comparison of CPT logs to reference boring logs showed good correlations with the stratigraphic units. At Site 4 only, soil samples were collected from the reference boring for chemical analysis and the reference boring was converted to a deep well (D04-01, discussed in Section 3.5). Reference boring locations are shown on Figure 3-1 for Site 4; Figure 3-2 for Sites 5, 8, 10A and 12; and Figure 3-3 for Site 14.

Reference borings were installed in accordance with the Phases 2B and 3 FSP using continuous core, mud-rotary drilling techniques. At each of the sites, except for Site 4, conductor casing was installed

in the Holocene Bay Mud to prevent possible cross contamination of the lower water-bearing zone during advancement. A conductor casing was not set at Site 4 due to the absence of the Holocene Bay Mud unit. The borings were terminated in the clay layer underlying the water-bearing zone (interpreted as the Yerba Buena Mud).

The reference boring at Site 4 (D04-01) was located adjacent to CPT point CPT-S04-03 on the south side of Building 360. The boring extended to a depth of 101 feet bgs and was later converted to a deep monitoring well. The boring was terminated approximately 4.5 feet into the clay layer underlying the Merritt Sand (Yerba Buena Mud).

The reference boring at Site 5 (REF-S05-01) was located adjacent to CPT point CPT-S05-01 at the northwest corner of Building 5. Conductor casing was installed to a depth of 23 feet bgs into the Holocene Bay Mud. The boring extended to a depth of 117 feet bgs and was terminated after penetrating into approximately 5 feet of Yerba Buena Mud.

The reference boring at Site 8 (REF-S08-01) was located adjacent to CPT point CPT-S08-01 on the northwest side of Building 114. Conductor casing was installed to a depth of 21.5 feet bgs into the Holocene Bay Mud. The boring extended to a depth of 110 feet bgs and was terminated after penetrating into approximately 10 feet of Yerba Buena Mud.

The reference boring at Site 10A (REF-S10A-01) was located adjacent to CPT point CPT-S10A-03 at the southeast corner of Building 400. Conductor casing was installed to a depth of 20 feet bgs into the Holocene Bay Mud. The boring extended to a depth of 98 feet bgs and was terminated after penetrating into approximately 9 feet of Yerba Buena Mud.

The reference boring at Site 12 (REF-S12-01) was located adjacent to CPT point CPT-S12-04, south of Building 10. Conductor casing was installed to a depth of 33.5 feet bgs into the Holocene Bay Mud. The boring extended to a depth of 94 feet bgs and was terminated after penetrating into approximately 8 feet of Yerba Buena Mud.

The reference boring at Site 14 (REF-S14-01) was located adjacent to CPT point CPT-S14-03, south of the bermed area. Conductor casing was installed to a depth of 21 feet bgs into the Holocene Bay

Mud. The boring extended to a depth of 95 feet bgs and was terminated after penetrating into approximately 8 feet of Yerba Buena Mud.

3.5 DEEP WELL INSTALLATION

Eight deep wells (ranging from 70 to 98 feet bgs) were installed under CTO 0260 to monitor water quality in the second water-bearing zone. Seven of the deep wells were installed approximately midway into the second water-bearing zone and one well (at Site 4) was installed on top of the clay layer underlying the water-bearing zone (Yerba Buena Mud).

Deep wells were installed in accordance with the Phases 2B and 3 FSP (PRC and Montgomery Watson 1994) using mud-rotary drilling techniques with conductor casing installed using HSA drilling techniques. The deep wells were installed using 3-inch Schedule 40 PVC riser, 0.010-inch slot screen, and number 2/12 Monterey Sand instead of number 2/16 as discussed in Section 3.3 for shallow wells. Locations and screening intervals of these deep wells were selected based on HydroPunch groundwater quality data (see Section 4.0 for a discussion on HydroPunch analytical data), as well as adequate spatial distribution of the deep wells for groundwater gradient evaluation. Where feasible, wells were installed adjacent to shallow monitoring wells to assess vertical groundwater gradient, and adjacent to reference borings for lithologic control during screen placement. One well was installed at each site, except for Site 5, where three wells were installed. Table 3-5 summarizes the well construction information. Deep well locations are shown on Figure 3-1 for Site 4; Figure 3-2 for Sites 5, 8, 10A and 12; and Figure 3-3 for Site 14. Soil sampling was not conducted during the installation of deep wells, with the exception of the deep well installed at Site 4, which is discussed below. Table 3-6 summarizes the chemical analyses performed on soil and groundwater samples collected from the deep wells.

Site 4

One deep well was installed at Site 4. Deep monitoring well D04-01 was placed on the south side of Building 360, adjacent to shallow monitoring well MW360-3 and HydroPunch location CPT-S04-03. HydroPunch analytical results did not indicate the presence of elevated chemicals in groundwater; however, the well will be used in conjunction with two other wells to be installed north and east of

Building 360, where HydroPunch results indicated the presence of VOCs in groundwater. The two additional deep wells will be installed after additional soil and groundwater data are collected. Deep well D04-01 will be used as a third location to assess the deep horizontal groundwater flow gradient at Site 4. Monitoring well D04-01 was installed on top of the Yerba Buena Mud to assess the lateral extent of TCE found at depth in HydroPunch samples north and east sides of Building 360. Soil samples were collected for additional assessment of possible TCE at depth. The well was screened from a depth of 86 to 98 feet bgs.

Site 5

Three deep wells (D05-01, 02, and 03) were installed at Site 5 to assess the lateral extent of VOCs in the second water-bearing zone. HydroPunch results from the northeast portion of Site 5 indicate low levels of VOCs in HydroPunch sample CPT-S05-03 (see Section 4.0). Monitoring well D05-02 was placed south of CPT-S05-03 and adjacent to M05-07 (on the east side of Building 5); the well was screened from a depth of 60 feet to 70 feet bgs, approximately midway into the second water-bearing zone. Monitoring well D05-01 was placed at the northwest corner of Building 5 and screened approximately midway into the second water-bearing zone, from 60 to 70 feet bgs. Monitoring well D05-03 was placed at the west-southwest corner of Building 5, adjacent to M05-06, screened midway into the second water-bearing zone, from 57 to 67 feet bgs.

Site 8

One deep well (D08-01) was installed at Site 8, at the northwest corner of Building 114, adjacent to shallow monitoring well M08-02 and CPT location CPT-S08-01, to assess the deep groundwater flow gradient. This well, in conjunction with nearby deep wells at Sites 5 and 12 will provide adequate data for gradient determination. Low levels of VOCs were detected in HydroPunch samples from CPT-S08-01 and CPT-S08-03. Monitoring well D08-01 was screened from a depth of 60 to 70, approximately midway into the second water-bearing zone.

Site 10A

There were no potential chemicals of interest detected in the HydroPunch samples from Site 10A. A deep well (D10A-01) was installed at the southeast corner of Building 400, adjacent to shallow monitoring well M10-02 and CPT location CPT-S10A-03. D10A-01 was installed to assess the deep groundwater gradient and will be evaluated in conjunction with nearby deep wells. Monitoring well D10A-01 was screened from a depth of 60 to 70 feet bgs, approximately midway into the second water-bearing zone.

Site 12

Low levels of VOCs were detected in the HydroPunch sample collected from CPT-S12-01. A deep well (D12-01) was installed adjacent to shallow monitoring well M12-04 and CPT location CPT-S12-03 on the southeast corner of Building 10 and will be used in conjunction with nearby deep wells, from Sites 5, 8, and 10A, to assess deep groundwater gradient. Monitoring well D12-01 was screened from a depth of 60 to 70 feet bgs, approximately midway into the second water-bearing zone.

Site 14

No VOCs were detected in the HydroPunch samples at Site 14. A deep well (D14-01) was installed south of the bermed area, adjacent to shallow monitoring well M14-03 and CPT location CPT-S14-03. The well will be used in conjunction with other deep wells in the vicinity of Site 14 to assess deep groundwater gradients. Monitoring well D14-01 was screened from a depth of 65 to 75 feet bgs, approximately midway into the second water-bearing zone.

3.6 NON-POINT SOURCE SAMPLING

NPS sediment samples were collected from storm sewer catch basins to assess the potential for these utilities to act as NPSs transporting chemicals off site. The NPS samples were collected in accordance with the Phases 2B and 3 FSP. The sample locations described in the Phases 2B and 3 FSP are based on an evaluation of the base utility maps supplied by NAS Alameda. Sample locations

are shown on Figure 3-1 for Site 4; Figure 3-2 for Sites 5, 8, 10A and 12; and Figure 3-3 for Site 14. The sample collection points were generally located downstream and upstream of building discharges.

The NPS samples were collected in February, March, and April 1994. Table 3-7 presents a summary of the NPS investigation at each site as well as any deviations from the FSP.

3.7 GROUNDWATER MEASUREMENT AND SAMPLING

A total of four quarterly sampling events are scheduled for the shallow and deep wells at the six sites between 1994 and 1995. The analytical results of the first quarterly sampling event are discussed in Section 4.0 of this data transmittal memorandum. The results of the remaining quarterly sampling events will be presented in the RI reports. The first quarterly groundwater sampling event was conducted between June and July 1994, after all of the newly installed wells were developed. Groundwater measurement, well development, and groundwater sampling were all conducted in accordance with the Phases 2B and 3 FSP.

All newly installed monitoring wells were developed as soon as possible, but not before 48 hours following installation. Wells were surged, and at least three times the standing well volume, including the volume of the sand filter pack, was purged. During the purging process, the specific conductance, pH, turbidity, and water temperature were periodically measured. Details of well development are included in Section 14.0 of the Phases 2B and 3 FSP.

All wells were sampled no sooner than two days after development. Prior to sampling, a water level measurement was obtained using an electronic water-level reader; this value was used for evaluating groundwater gradient and for calculating the volume of the standing water in the well to be purged. The purging and sampling processes adhered to the guidelines presented in Section 14.0 of the Phases 2B and 3 FSP. Depth to groundwater measurements are shown in Table 3-8.

3.8

SITE SURVEYING

All field surveying was performed in accordance with the Phases 2B and 3 FSP. Additionally, elevations of the CPT and HydroPunch sample points were surveyed. To add both location and elevation control, some wells from the previous investigations were resurveyed at Sites 4 and 8.

As specified in the FSP, elevations were surveyed relative to the 1929 U.S. Geological Survey (USGS) mean lower low water (MLLW) datum. To remain consistent with standard survey practices used by NAS Alameda Facilities Management Office, a baseline of 100 feet was added to the MLLW datum to remove the possibility of negative elevations. Surveyed elevations for the well top of casings are presented in Table 3-8.

TABLE 3-1
CTO 260 NAS ALAMEDA
CPT AND HYDROPUNCH DEPTHS

Site	CPT I.D.	CPT Depth (feet)	Hydropunch Depth (feet)
4	CPT-S04-01	59.9	20.0
	CPT-S04-02	44.3	20.0
	CPT-S04-03	45.1	19.0
	CPT-S04-04	REFUSAL	REFUSAL
5	CPT-S05-01	43.5	42.5
	CPT-S05-02	66.4	65.0
	CPT-S05-03	55.8	58.0
	CPT-S05-04	43.5	46.0
	CPT-S05-05	40.2	42.0
	CPT-S05-06	41.0	43.0
	CPT-S05-07	47.6	47.0
8	CPT-S08-01	36.9	37.5
	CPT-S08-02	35.3	36.0
	CPT-S08-03	46.8	31.0
	CPT-S08-04	46.8	36.0
10A	CPT-S10A-01	36.9	37.5
	CPT-S10A-02	35.3	36.0
	CPT-S10A-03	46.8	31.0
	CPT-S10A-04	46.8	36.0
12	CPT-S12-01	32.8	29.0
	CPT-S12-02	50.9	52.0
	CPT-S12-03	50.0	19.0
	CPT-S12-04	52.5	22.0
14	CPT-S14-01	48.4	29.0
	CPT-S14-02	48.4	INACCESSIBLE
	CPT-S14-03	44.3	19.0

TABLE 3-2

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON HYDROPUNCH GROUNDWATER SAMPLES

Site	Field ID	Analysis (Method)						
		VOC (CLP)	SVOC (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
4	CPT-S04-01	X	X	X	X	X		X
	CPT-S04-02	X	X	X	X	X		X
	CPT-S04-03	X	X	X	X	X		X
5	CPT-S05-01	X	X			X	X	X
	CPT-S05-02	X	X			X	X	X
	CPT-S05-03	X	X			X	X	X
	CPT-S05-04	X	X			X	X	X
	CPT-S05-05	X	X			X	X	X
	CPT-S05-06	X	X			X	X	X
	CPT-S05-07	X	X			X	X	X
8	CPT-S08-01	X				X		X
	CPT-S08-02	X	X			X		X
	CPT-S08-03	X	X			X		X
	CPT-S08-04	X	X			X		X
10A	CPT-S10A-01	X				X		X
	CPT-S10A-02	X				X		X
	CPT-S10A-03	X				X		X
	CPT-S10A-04	X				X		X

TABLE 3-2
CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON HYDROPUNCH GROUNDWATER SAMPLES
(Continued)

Site	Field ID	Analysis (Method)						
		VOC (CLP)	SVOC (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
12	CPT-S12-01	X	X			X		X
	CPT-S12-02	X	X			X		X
	CPT-S12-03	X	X			X		X
	CPT-S12-04	X	X			X		X
14	CPT-S14-01	X				X		X
	CPT-S14-02	X				X		X
	CPT-S14-03	X				X		X

Notes:

CLP - Contract Laboratory Program

General Chems - General Chemicals

General chemicals for soil samples include:

Total Organic Carbon

pH

% moisture

General chemicals were analyzed on soil samples selected randomly at a 10 percent frequency

MOD 8015 - Modified EPA Method 8015

SAS - Special Analytical Services

TPH-Purg - Total Petroleum Hydrocarbons, purgeable

TPH-Extr - Total Petroleum Hydrocarbons, extractable

TABLE 3-3

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SURFACE SOIL SAMPLES

Site	Field ID	Analysis Method						
		PCB (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Dioxin/Furan (CLP SAS B)	General Chems
8	S08-01	X				X		
	S08-02	X				X		
	S08-03	X				X		
14	S14-01		X	X	X			X
	S14-02		X	X	X			
	S14-03		X	X	X		X	X
	S14-04		X	X	X		X	X
	S14-05		X	X	X		X	
	S14-06		X	X	X		X	
	S14-07		X	X	X		X	X
	S14-08		X	X	X		X	
	S14-09		X	X	X			X

Notes:

CLP - Contract Laboratory Program

General Chems - General Chemicals

General chemicals for soil samples include:

Total Organic Carbon

pH

% moisture

General chemicals were analyzed on soil samples selected randomly at a 10 percent frequency

MOD 8015 - Modified EPA Method 8015

Pest - Pesticides

SAS - Special Analytical Services

TPH-Purg - Total Petroleum Hydrocarbons, purgeable

TPH-Extr - Total Petroleum Hydrocarbons, extractable

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
4	Soil	B04-21	0	X	X			X	X	X	X	X
	Soil	B04-21	2.5	X	X			X	X	X	X	X
	Soil	B04-21	5	X	X			X	X	X	X	X
	Soil	B04-22	0	X	X			X	X	X	X	X
	Soil	B04-22	2.5	X	X			X	X	X	X	X
	Soil	B04-22	5	X	X			X	X	X	X	X
	Soil	B04-23	0	X	X			X	X	X	X	X
	Soil	B04-23	2.5	X	X			X	X	X	X	X
	Soil	B04-23	5	X	X			X	X	X	X	X
	Soil	B04-24	0	X	X			X	X	X	X	X
	Soil	B04-24	2.5	X	X			X	X	X	X	X
	Soil	B04-24	5	X	X			X	X	X	X	X
	Soil	B04-25	0		X			X	X	X	X	X
	Soil	B04-25	2.5	X	X			X	X	X	X	X
	Soil	B04-26	0		X			X	X	X	X	X
	Soil	B04-26	2.5	X	X			X	X	X	X	X
	Soil	B04-27	0		X			X	X	X	X	X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	B04-27	2.5	X	X			X	X	X	X	X
	Soil	B04-28	0		X			X	X	X	X	X
	Soil	B04-28	2.5	X	X			X	X	X	X	X
	Soil	B04-29	0		X			X	X	X	X	X
	Soil	B04-29	2.5	X	X			X	X	X	X	X
	Soil	B04-30	0		X			X	X	X	X	X
	Soil	B04-30	2.5	X	X			X	X	X	X	X
	Soil	B04-31	0		X			X	X	X	X	X
	Soil	B04-31	2.5	X	X			X	X	X	X	X
	Soil	B04-32	0		X			X	X	X	X	X
	Soil	B04-32	2.5	X	X			X	X	X	X	X
	Soil	B04-33	0		X			X	X	X	X	X
	Soil	B04-33	2.5	X	X			X	X	X	X	X
	Soil	B04-34	0		X			X	X	X	X	X
	Soil	B04-34	2.5	X	X			X	X	X	X	X
	Soil	B04-35	0		X			X	X	X	X	X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	B04-35	2.5	X	X			X	X	X	X	X
	Soil	B04-36	0		X			X	X	X	X	X
	Soil	B04-36	2.5	X	X			X	X	X	X	X
	Soil	B04-37	0	X	X			X	X	X	X	X
	Soil	B04-37	2.5	X	X			X	X	X	X	X
	Soil	B04-38	0	X	X			X	X	X	X	X
	Soil	B04-38	2.5	X	X			X	X	X	X	X
	Soil	B04-39	0	X	X			X	X	X	X	X
	Soil	B04-39	2.5	X	X			X	X	X	X	X
	Soil	B04-40	0	X	X			X	X	X	X	X
	Soil	B04-40	2.5	X	X			X	X	X	X	X
	Soil	B04-42	0	X	X			X	X	X	X	X
	Soil	B04-42	2.5	X	X			X	X	X	X	X
	Soil	B04-42	5	X	X			X	X	X	X	X
	Soil	M04-05	0	X	X			X	X	X	X	X
	Soil	M04-05	2.5	X	X			X	X	X	X	X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	VOC (CLP)	SVOC (CLP)	Analysis (Method)						
						Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	M04-05	5	X	X			X	X	X	X	X
	Soil	M04-06	0	X	X			X	X	X	X	X
	Soil	M04-06	2.5	X	X			X	X	X	X	X
	Soil	M04-06	5	X	X			X	X	X	X	X
	Soil	M04-07	0	X	X			X	X	X	X	X
	Soil	M04-07	2.5	X	X			X	X	X	X	X
	Soil	M04-07	5	X	X			X	X	X	X	X
4	Water	MW360-1-Q1		X	X			X	X	X	X	X
	Water	MW360-2-Q1		X	X			X	X	X	X	X
	Water	MW360-3-Q1		X	X			X	X	X	X	X
	Water	MW360-4-Q1		X	X			X	X	X	X	X
	Water	M04-5-Q1		X	X			X	X	X	X	X
	Water	M04-6-Q1		X	X			X	X	X	X	X
	Water	M04-7-Q1		X	X			X	X	X	X	X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
5	Soil	B05-14	0	X								X
	Soil	B05-14	2.5	X								X
	Soil	B05-14	5	X								
	Soil	B05-15	0	X								
	Soil	B05-15	2.5	X								
	Soil	B05-15	5	X								X
	Soil	B05-16	0	Listed as M05-07 0								
	Soil	B05-16	2.5	Listed as M05-07 2.5								
	Soil	B05-16	5	Listed as M05-07 5								
	Soil	M05-06	0	X								X
	Soil	M05-06	2.5	X								
	Soil	M05-06	5	X								X
	Soil	M05-07	0	X								X
	Soil	M05-07	2.5	X								
	Soil	M05-07	5	X								
	Soil	M05-08	0	X								

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	M05-08	2.5	X								
	Soil	M05-08	5	X								
	Soil	M05-09	0	X								
	Soil	M05-09	2.5	X								X
	Soil	M05-09	5	X								X
	Soil	M05-10	0	X								
	Soil	M05-10	2.5	X								
	Soil	M05-10	5	X								
5	Water	M05-10-Q1		X	X					X	X	X
	Water	M05-02-Q1		X	X					X	X	X
	Water	M05-03-Q1		X	X					X	X	X
	Water	M05-04-Q1		X	X					X	X	X
	Water	M05-05-Q1		X	X					X	X	X
	Water	M05-06-Q1		X	X					X	X	X
	Water	M05-07-Q1		X	X					X	X	X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Water	M05-08-Q1		X	X					X	X	X
	Water	M05-09-Q1		X	X					X	X	X
	Water	M05-10-Q1		X	X					X	X	X
	Water	M05BS-01-Q1		X	X					X	X	X
	Water	M05HW-01-Q1		X	X					X	X	X
8	Soil	M08-06	0	Sample lost								
	Soil	M08-06	2.5	X	X		X			X		X
	Soil	M08-06	5	X	X		X			X		X
	Soil	M08-07	0	X	X		X			X		
	Soil	M08-07	2.5	X	X		X			X		X
	Soil	M08-07	5	X	X		X			X		
8	Water	M08-01-Q1		X	X	X	X			X		X
	Water	M08-02-Q1		X	X	X	X			X		X
	Water	M08-03-Q1		X	X	X	X			X		X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
10A	Water	M08-04-Q1		X	X	X	X			X		X
	Water	M08-05-Q1		X	X	X	X			X		X
	Water	M08-06-Q1		X	X	X	X			X		X
	Water	M08-07-Q1		X	X	X	X			X		X
	Water	M10A-01-Q1		X	X					X		X
	Water	M10A-02-Q1		X	X					X		X
	Water	M10A-03-Q1		X	X					X		X
	Water	M10A-04-Q1		X	X					X		X
	Water	M111A-Q1		X	X					X		X
	Water	M12-01-Q1		X	X			X	X	X		X
12	Water	M12-02-Q1		X	X			X	X	X		X
	Water	M12-03-Q1		X	X			X	X	X		X
	Water	M12-04-Q1		X	X			X	X	X		X
	Water	M12-04-Q1		X	X			X	X	X		X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
14	Soil	B14-04	0	X				X	X			X
	Soil	B14-04	2.5	X				X	X			
	Soil	B14-04	5	X				X	X			
	Soil	B14-05	0	X				X	X			
	Soil	B14-05	2.5	X				X	X			X
	Soil	B14-05	5	X				X	X			
	Soil	B14-06	0	X				X	X			X
	Soil	B14-06	2.5	X				X	X			X
	Soil	B14-06	5	X				X	X			
	Soil	B14-07	0	X				X	X			
	Soil	B14-07	2.5	X				X	X			X
	Soil	B14-07	5	X				X	X			X
	Soil	B14-08	0	X				X	X			X
	Soil	B14-08	2.5	X				X	X			X
	Soil	B14-08	5	X				X	X			
	Soil	B14-09	0	X				X	X			

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	VOC (CLP)	SVOC (CLP)	Analysis (Method)						
						Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	B14-09	2.5	X				X	X			X
	Soil	B14-09	5	X				X	X			X
	Soil	B14-10	0	X				X	X			
	Soil	B14-10	2.5	X				X	X			X
	Soil	B14-10	5	X				X	X			
	Soil	B14-11	0	X				X	X			X
	Soil	B14-11	2.5	X				X	X			
	Soil	B14-11	5	X				X	X			
	Soil	B14-12	0	X				X	X			
	Soil	B14-12	2.5	X				X	X			X
	Soil	B14-12	5	X				X	X			
	Soil	B14-13	0	X				X	X			
	Soil	B14-13	2.5	X				X	X			
	Soil	B14-13	5	X				X	X			X
	Soil	B14-14	0	X				X	X			
	Soil	B14-14	2.5	X				X	X			X

TABLE 3-4

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON SHALLOW SOIL AND GROUNDWATER SAMPLES
(Continued)

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
	Soil	B14-14	5	X				X	X			
14	Water	M14-01-Q1		X	X		X	X	X	X		X
	Water	M14-02-Q1		X	X		X	X	X	X		X
	Water	M14-03-Q1		X	X		X	X	X	X		X

Notes:

CLP - Contract Laboratory Program

General Chems - General Chemicals

General chemicals for soil samples include:

Total Organic Carbon

pH

% moisture

General chemicals were analyzed on soil samples selected randomly at a 10 percent frequency

General chemicals for groundwater pH

Total Dissolved Solids

Alkalinity

Acidity

Chemical Oxygen Demand

Sulfate

Sulfide

Total Organic Carbon

Chloride

Fluoride

Hardness

Nitrate/Nitrite

MOD 8015 - Modified EPA Method 8015

Pest - Pesticides

SAS - Special Analytical Services

TPH-Purg - Total Petroleum Hydrocarbons, purgeable

TPH-Extr - Total Petroleum Hydrocarbons, extractable

TABLE 3-5

**CTO 260 NAS ALAMEDA
"DEEP" MONITORING WELL CONSTRUCTION DETAIL**

Site Number	Well Number	Installed By Date	Reference Elevation top of casing (feet above MLLW) ^a	Screened Interval (feet bgs) ^b	Filter Pack Interval (feet bgs)
4	D04-01	Montgomery Watson 5/14/94	113.91	86 to 96	84 to 96
5	D05-01	Montgomery Watson 6/1/94	113.5	60 to 70	57.5 to 70
5	D05-02	Montgomery Watson 6/2/94	113.6	57 to 67	54.5 to 67
5	D05-03	Montgomery Watson 6/7/94	111.72	57 to 67	54.5 to 67
8	D08-01	Montgomery Watson 5/20/94	114.2	60 to 70	58 to 70
10A	D10A-01	Montgomery Watson 5/26/94	112.76	60 to 70	57.5 to 70
12	D12-01	Montgomery Watson 5/25/94	112.19	60 to 70	57.5 to 70
14	D14-01	Montgomery Watson 5/18/94	110.41	65 to 75	63 to 75

^a Elevations are presented in feet above mean lower low water (MLLW), with 100 feet added to eliminate negative elevations.

^b bgs = below ground surface

TABLE 3-6

CTO 260 NAS ALAMEDA
SUMMARY OF ANALYSES PERFORMED ON DEEP MONITORING WELL SOIL AND GROUNDWATER SAMPLES

Site	Matrix	Field ID	Depth (ft)	Analysis (Method)								
				VOC (CLP)	SVOC (CLP)	Filtered SVOC (CLP)	Pest/PCB (CLP)	TPH-Purg (MOD 8015)	TPH-Extr (MOD 8015)	Metals (CLP)	Cyanide (CLP)	General Chems
4	Soil	D04-01	75	X								
	Soil	D04-01	89	X								
	Soil	D04-01	91	X								
	Soil	D04-01	100	X								
4	Water	D04-01-Q1		X				X	X	X	X	X
5	Water	D05-01-Q1		X						X	X	X
	Water	D05-02-Q1		X						X	X	X
	Water	D05-03-Q1		X						X	X	X
8	Water	D08-01-Q1		X	X	X	X			X		X
10A	Water	D10A-01-Q1		X						X		X
12	Water	D12-01-Q1		X						X		X
14	Water	D14-01-Q1		X						X		X

Notes:

CLP - Contract Laboratory Program

General Chems - General Chemicals

General chemicals for groundwater pH

Total Dissolved Solids

Alkalinity

Acidity

Chemical Oxygen Demand

Sulfate

Nitrate

Total Organic Carbon

Chloride

Fluoride

Hardness

Sulfide

MOD 8015 - Modified EPA Method 8015

Pest - Pesticides

Q1 - First quarter of groundwater sampling

TPH-Purg - Total Petroleum Hydrocarbons, purgeable

TPH-Extr - Total Petroleum Hydrocarbons, extractable

TABLE 3-7
CTO 260 NAS ALAMEDA
SUMMARY OF NON-POINT SOURCE SAMPLES

Site	Number of Samples	Analyses	Comments
4	3	VOCs SVOCs TPH-purgeable, extractable cyanide metals	A scheduled duplicate sample at NPS-S04-02 could not be collected due to a limited amount of sediment available
5	4	VOCs SVOCs TPH-purgeable, extractable metals	No deviations from the FSP
8	2	VOCs SVOCs TPH-purgeable, extractable pesticides and PCBs metals	NPS-S08-03 was not collected because the catch basin was filled with paint chips and the grate was jammed in place.
10A	2	VOCs SVOCs TPH-purgeable, extractable metals	No deviations from the FSP
12	3	VOCs SVOCs TPH-purgeable, extractable metals	No deviations from the FSP
14	1	VOCs SVOCs TPH-purgeable, extractable metals	No deviations from the FSP

Notes:

VOC - Volatile organic compound

SVOC - Semivolatile organic compound

FSP - Field sampling plan

TPH - Total petroleum hydrocarbon

PCB - Polychlorinated biphenyl

TABLE 3-8

**CTO 260 NAS ALAMEDA
DEPTH TO GROUNDWATER MEASUREMENTS**

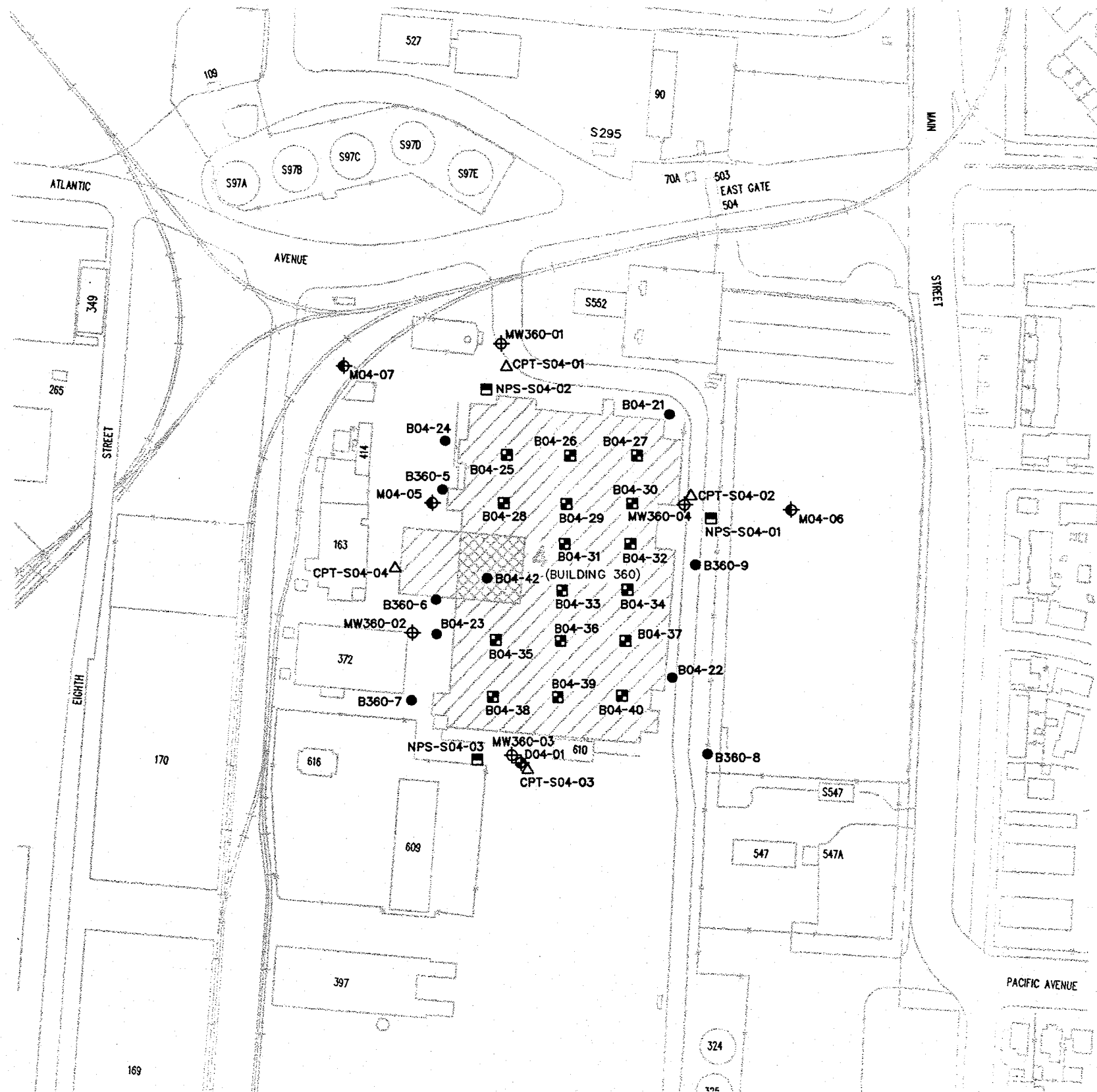
Site	Well I.D.	Measurement Date	Time of Measurement	Depth to Groundwater (ft)	Elevation Top of Casing (ft above MLLW ^a)	Groundwater Elevation (ft above MLLW ^a)
4	Shallow Wells					
	MW360-1	6/20/94	1302	4.44	112.73	108.29
	MW360-2	6/20/94	1416	5.05	113.74	108.69
	MW360-3	6/20/94	1331	4.65	113.80	109.15
	MW360-4	6/20/94	1344	4.39	113.67	109.28
	M04-05	6/20/94	1310	4.68	114.18	109.50
	M04-06	6/20/94	1352	4.31	113.79	109.48
	M04-07	6/20/94	1242	5.60	113.27	107.67
	Deep Wells					
	D04-01	6/20/94	1327	6.91	113.91	107.00
5	Shallow Wells					
	M05-01	6/20/94	850	7.02	112.03	105.01
	M05-02	6/20/94	1000	6.38	111.80	105.42
	M05-03	6/20/94	1035	4.96	111.12	106.16
	M05-04	6/20/94	945	6.94	111.83	104.89
	M05-05	6/20/94	907	6.91	110.98	104.07
	M05-06	6/20/94	935	4.69	111.74	107.05
	M05-07	6/20/94	857	7.00	113.40	106.40
	M05-08	6/20/94	932	8.36	114.54	106.18
	M05-09	6/20/94	915	6.80	112.52	105.72
	M05-010	6/20/94	1010	6.69	114.30	107.61
	M05BS-1	6/20/94	915	7.53	113.19	105.66
	M05HW-01	6/20/94	1035	5.78	112.57	106.79
	Deep Wells					
	D05-01	6/20/94	850	7.24	113.50	106.26
	D05-02	6/20/94	850	7.6	113.60	106.00
	D05-03	6/20/94	933	5.87	111.72	105.85
8	Shallow Wells					
	M08-01	6/20/94	1410	5.82	111.35	105.53
	M08-02	6/20/94	1233	7.60	112.95	105.35
	M08-03	6/20/94	1245	5.72	111.48	105.76
	M08-04	6/20/94	1305	4.65	110.26	105.61
	M08-05	6/20/94	1332	4.32	110.04	105.72
	M08-06	6/20/94	1325	5.00	111.99	106.99
	M08-07	6/20/94	1356	6.27	112.91	106.64
	Deep Wells					
	D08-01	6/20/94	1230	7.96	114.20	106.24

TABLE 3-8

**CTO 260 NAS ALAMEDA
DEPTH TO GROUNDWATER MEASUREMENTS
(Continued)**

Site	Well I.D.	Measurement Date	Time of Measurement	Depth to Groundwater (ft)	Elevation Top of Casing (ft above MLLW ^a)	Groundwater Elevation (ft above MLLW ^a)
10A	Shallow Wells					
	M10A-01	6/20/94	1100	4.20	110.62	106.42
	M10A-02	6/20/94	1135	4.20	111.00	106.80
	M10A-03	6/20/94	1117	3.24	110.16	106.92
	Deep Wells					
	D10A-01	6/20/94	1134	7.48	112.76	105.28
12	Shallow Wells					
	M12-01	6/20/94	1140	7.71	111.56	103.85
	M12-02	6/20/94	1127	6.45	110.94	104.49
	M12-03	6/20/94	1049	5.70	110.72	105.02
	M12-04	6/20/94	1109	5.35	110.60	105.25
	Deep Wells					
	D12-01	6/20/94	1104	6.43	112.19	105.76
14	Shallow Wells					
	M14-01	6/20/94	1645	5.41	109.73	104.32
	M14-02	6/20/94	1500	5.13	110.15	105.02
	M14-03	6/20/94	1513	5.43	111.15	105.72
	Deep Wells					
	D14-01	6/20/94	1508	6.82	110.41	103.59

^a Elevations are presented in feet above mean lower low water (MLLW) with 100 feet added to eliminate negative elevations (see Section 3.8).



PLATING SHOP
SITE LOCATION

- ⊕ SHALLOW MONITORING WELL LOCATION
EXISTING BEFORE CTO 260
- ⊕ SHALLOW MONITORING WELL LOCATION
INSTALLED DURING CTO 260
- ⊕ DEEP MONITORING WELL LOCATION
INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- △ CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT
SAMPLE LOCATION

DATE: 01/25/96 .M DN FILE NAME: E:\ALAMEDA\HITSMAP.DWG

FIGURE 3-1
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
SAMPLE LOCATIONS



LEGEND

- | | | | |
|--|---|--|---|
| | SITE LOCATION | | SOIL BORING LOCATION |
| | FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260 | | REFERENCE BORING INSTALLED DURING CTO 260 |
| | FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260 | | CPT/HYDROPUNCH LOCATION |
| | SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260 | | SURFACE SOIL SAMPLE LOCATION |
| | | | NON-POINT SOURCE SEDIMENT SAMPLE LOCATION |

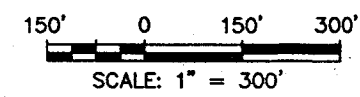
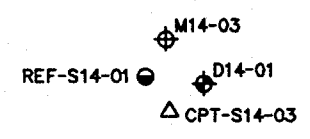
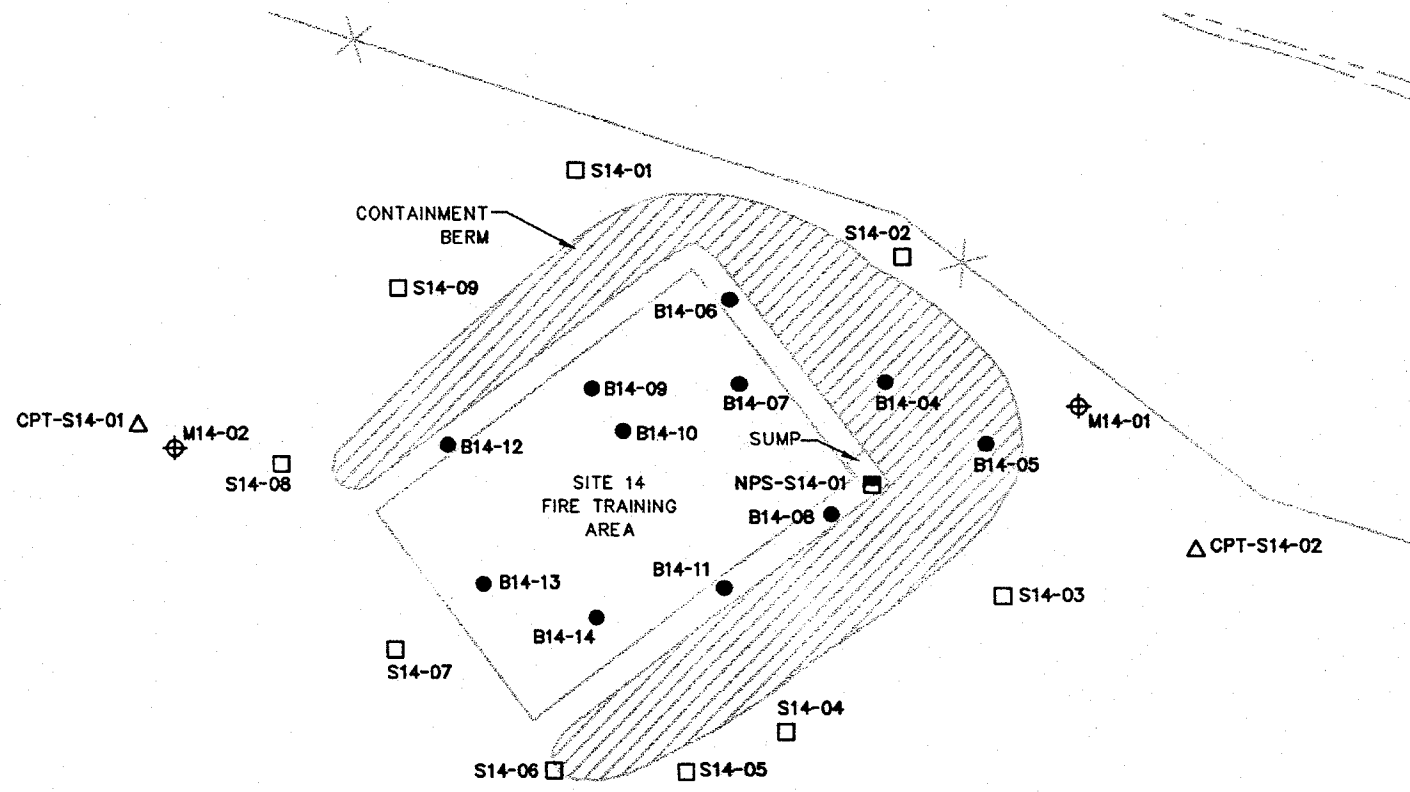


FIGURE 3-2
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
SAMPLE LOCATIONS

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/26/01
J.M. DN



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

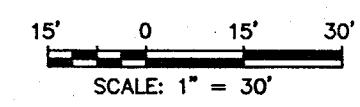


FIGURE 3-3
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
SAMPLE LOCATIONS

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/28/93
JCM DN

4.0 INVESTIGATION RESULTS

The lithologic findings, groundwater flow findings, and analytical results are discussed in this section.

The analytical results of this investigation, including the chemicals of interest in soil and groundwater, are presented on the figures and tables contained in this section. The chemicals of interest include organic compounds and metals that were either detected during previous investigations or were selected and analyzed for, based on past and present industrial activity at Alameda NAS. Organic compounds (VOCs, SVOCs, pesticides, PCBs, dioxins and TPH) that were detected above the detection limit are presented on the attached figures. Metals in groundwater that were detected above the detection limit are also shown on the attached figures. The metals shown do not include the major cations, calcium, magnesium, iron, potassium, sodium, manganese, or aluminum, as these are ubiquitous in the environment and typically not industrially related. Concentrations for these metals can be found in the analytical tables included as Attachment 3. The remaining groundwater metals included in the metals' analysis are shown on the figures, including arsenic, barium, chromium, mercury, molybdenum, selenium, and vanadium. Metals in soils are not shown on the figures due to their common occurrence in the environment, but, rather, are compared to two reference standards, as discussed in Section 4.2. Concentrations of metals in soil can also be found in analytical tables included as Attachment 3.

4.1 REGIONAL LITHOLOGIC FINDINGS

The results from this investigation indicate that lithology and hydrogeology varies among Site 4, Sites 5, 8, 10A, and 12, and Site 14. The lithology at Site 4 generally consists of an approximately 10-foot-thick silty fill overlying more permeable sands (Merritt Sand). The lithology in the area of Sites 5, 8, 10A, and 12 consists of an approximately 10-foot-thick silty fill overlying a less permeable silt or clay unit (the Holocene Bay Mud). The Holocene Bay Mud unit ranges from approximately 25 feet thick (Site 10A) to 70 feet thick (Site 8), and is underlain by a dense sand, presumably the Merritt Sand. At Site 14, the fill layer is approximately 10 feet thick and is underlain by a less permeable silty to clayey unit (Holocene Bay Mud) approximately 25 feet thick, in turn overlying a dense sand (presumably the Merritt Sand). In general, these findings support the idealized cross section represented in Figure 2-2, except for Site 4, where there is no Bay Mud unit.

This section describes the analytical results for soil samples. Soil analyses were performed on samples collected from Sites 4, 5, 8, and 14. Figures 4-1 through 4-8 present organic compounds present above detection limits at these sites. Metals concentrations in soils are not shown on the figures as they occur naturally in the environment and their ubiquitous presence would call for maps that are too busy. A discussion of standards used to determine whether metals levels are elevated follows. The analytical data for organics and metals are tabulated in Attachment 3; these data tables present only compounds that were present above detection limits.

Metals concentrations in soil were compared to standards which were utilized during the Phases 1 and 2A, Phases 2B and 3, and Phase 5/6 investigations. The comparisons were made in order to be consistent with these investigations. During the investigations, metals concentrations in soils were compared to a statistical analysis of samples collected at NAS Alameda from locations where there was no known history of chemical usage or industrial activity. The samples collected for the statistical analysis in 1992 were obtained from the ground surface, 2 feet bgs, at the interface between fill and native sediments, and at 2 feet below the interface. Locations of the borings that were drilled to collect these samples are included as Attachment 5. The statistical analysis was used to estimate a concentration interval within which 95 percent of samples collected will fall 95 percent of the time, called the 95 percent/95 percent statistical tolerance interval (95/95 STI). Concentrations outside this range were identified as possibly indicative of conditions that are above or below ambient conditions for NAS Alameda. A thorough discussion of the evaluation of metals concentrations in soil is presented in the background data summary report (PRC and JMM 1992a) and the Phases 5 and 6 solid waste water quality assessment test (SWAT) and data summary report for RI/FS Phases 5 and 6 (PRC and Montgomery Watson 1993a). The results of the statistical analysis for soil are shown on Table 4-1. For this present investigation, soil and groundwater results from the first water-bearing zone were compared to the same 95/95 STI, and the results of the comparison are provided on Tables 4-2 and 4-3.

In addition, metals concentrations in soils are also compared to values that are 10 times the STLC, established by the State of California for the purpose of identifying potential areas of concern. The STLC value is used to define solid waste that would pose a water quality threat if it were subjected to

an acidic environment. For total metals concentrations in soil, the metal is considered to potentially pose a leachate problem when the concentration in the soil equals or exceeds 10 times the STLC value. A more thorough discussion, and an example calculation, of this rationale is included as Attachment 4.

Previous investigations also identified the ubiquitous presence of polycyclic aromatic hydrocarbons (PAHs) at many of the IRP sites at NAS Alameda. Most of the SVOCs detected during this study were also of the PAH class. For this technical memorandum, where appropriate, the following compounds will be referred to as the "PAH" class in soil at NAS Alameda: acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i,)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

4.2.1 Site 4

The following subsections discuss the analytical findings of analyses performed on soil samples collected from around the perimeter and beneath Building 360. The results of the organic analyses on soils are shown on Figures 4-1 through 4-3.

4.2.1.1 Soil Samples Collected at Building 360 Perimeter

Four shallow soil borings (B04-21, 22, 23, and 24) and three shallow monitoring wells (M04-05, 06, and 07) were installed around the perimeter of Building 360 to assess whether the soil had been impacted by petroleum hydrocarbons or other chemicals related to activities within the building. A total of 21 soil samples were collected from around the perimeter of the building and submitted for chemical analysis. Four soil samples were also collected from deep well D04-01 and analyzed for VOCs to assess the possibility of TCE in deeper soil samples. Soil samples were obtained from depths of 75, 89, 91, and 100 feet bgs.

VOCs. Concentrations found at each sample location are shown on Figure 4-1. Low levels of VOCs were detected in all seven shallow borings conducted around the Building 360 perimeter.

Ethylbenzene and xylenes were detected in each boring at 0, 2.5, or 5 feet bgs; 1,1,1-TCA was

detected at one boring located northwest of the building (B04-24) at a depth of 0 feet bgs; and carbon disulfide was detected in three borings east of Building 360 (B04-21, M04-06 and B04-22), at depths of 2.5 and 3 feet bgs. The low levels of ethylbenzene and xylenes were detected more often in this investigation than in the previous investigation. There were no VOCs detected in the soil samples obtained from deep monitoring well D04-01. The previous investigation detected low levels of toluene in the shallow soil samples taken from around the building perimeter, whereas, there was no toluene detected in any of the soil samples collected during this investigation. The previous investigation did not sample or analyze deeper soil samples for chemicals of interest.

SVOCs. Concentrations found at each sample location are shown on Figure 4-2. SVOCs were detected in four of the seven borings located at the northwest, northeast, and southeast corners of Building 360 (M04-07, B04-21, B04-22, and B04-24). The types of compounds detected were of the PAH class (except for n-nitrosodiphenylamine from the northwest corner of the building), and were found at depths of either 2.5 or 5 feet bgs. SVOC concentrations in soil samples were low for the samples collected at the northeast corner of the building, in boring B04-21. A previous investigation indicated similarly low (or below detection limits) levels of SVOCs around the perimeter of the building, with the exception of one location on the east-northeast side of the building (B04-21), where elevated levels of the PAH class of compounds were detected.

Metals and Cyanide. Cyanide concentrations are shown on Figure 4-2. Cyanide was not detected in soil samples collected from outside of Building 360. Concentrations of cyanide up to 1.11 mg/kg (at 12 feet bgs) were reported at three borings outside the building during the previous investigation.

Table 4-2 summarizes metals detected at Site 4 that exceeded the 95/95 STI and exceeded 10 times the STLC value. Lead exceeded 10 times the corresponding STLC value in only one sample, which was located northwest of Building 360 (M04-07 at 5 feet bgs).

TPH-Extractable. Concentrations of TPH-extractable (TPH-E) found at each sample location are shown on Figure 4-3. TPH-E as motor oil (C_{16} - C_{32}) was detected in six borings located on the west, north, and east sides of Building 360, at depths of 0, 2.5, or 5 feet bgs. The highest concentrations of TPH-E were detected from 0 and 2.5 feet bgs, in M04-05, located on the west side of the building. During the previous investigation, soil samples were not analyzed for TPH-E.

TPH-Purgeable. Concentrations of TPH-purgeable (TPH-P) found at each sample location are shown on Figure 4-3. As expected based on the VOC results, TPH-P results indicated the similar presence of low levels of ethylbenzene and xylenes in five of the sample locations. No other TPH-P constituents were detected. Soil samples collected around the building perimeter during the previous investigation were not analyzed for TPH-P.

4.2.1.2 Soil Samples Collected Beneath Building 360

Seventeen shallow soil borings were advanced beneath Building 360. Soil sample locations B04-25 through B04-40 were obtained on a grid pattern (spaced approximately 100 feet apart) beneath the main portion of Building 360. Samples were collected from depths of 0 and 2.5 feet bgs at each location. At boring B04-42, a soil sample, was also collected at a depth of 5 feet bgs. A total of 35 soil samples were collected for chemical analyses.

VOCs. Concentrations found at each sampling location are shown on Figure 4-1. Low levels of xylenes and ethylbenzene were detected in 10 of the 17 sample locations, most from the eastern portion of Building 360 at depths of 0 or 2.5 feet bgs. Low levels of carbon disulfide were detected in one soil sample collected at 2.5 feet bgs at the southeast corner of the building. The soil sample collected from beneath the plating shop (B04-42) contained low levels of 1,1,1-TCA and 1,1-DCE at 0, 2.5, and 5 feet bgs; 1,2-DCE was also detected in the 2.5-foot soil sample from the same boring. No comparison to previous investigations can be made since soil samples were not collected from beneath Building 360.

SVOCs. Concentrations found at each sampling location are shown on Figure 4-2. Low levels of the PAH class of SVOCs were detected in nine of the sampling locations from beneath the building, at depths of 0 or 2.5 feet bgs. SVOCs, predominantly PAHs, were also detected beneath the plating shop during earlier investigations.

Metals and Cyanide. Cyanide concentrations are shown on Figure 4-2. Low levels of cyanide were detected at 2.5 feet bgs at one location beneath the southern portion of the building (B04-39) and from the boring beneath the plating shop (B04-42). Cyanide concentrations were 0.39 and 0.31 mg/kg, respectively, at these locations. In 1982 and 1983, as part of the ERG study, samples were taken

from beneath the plating shop and analyzed for cyanide. A maximum concentration of 118 mg/kg of cyanide was reported. ERG's study did not report the exact sample locations, but presumed the samples to be from the southwest corner of the plating shop. A maximum cyanide concentration of 19 mg/kg was detected from one sample collected beneath the plating shop during the Phases 2B and 3 initial investigation.

Table 4-2 summarizes the metals detected at Site 4 at concentrations exceeding the 95/95 STI. The table also identifies those metals which are at concentrations exceeding 10 times the STLC. There were no metals detected which exceeded 10 times the STLC beneath Building 360.

TPH-E. Concentrations found at each sample location are shown on Figure 4-3. Elevated levels of TPH-E as motor oil ($C_{16}-C_{32}$) were detected at 15 of the soil sample locations beneath Building 360 (including the location beneath the plating shop), at 0 or 2.5 feet bgs. The highest concentration was detected in a 0-foot sample from the southwestern portion of the building, in boring B04-35. Two sample locations from the west-central side of the building (B04-31 and B04-42) also detected low levels of diesel. During the previous investigation, soil samples were not analyzed for TPH-E.

TPH-P. Concentrations found at each sample location are shown on Figure 4-3. Low levels of ethylbenzene and xylenes were detected in 8 of the 17 sample locations at depths and concentrations similar to the VOC soil results beneath Building 360. The samples in which TPH-P was detected were all collected from locations beneath the eastern half of the building. During the previous investigation, soil samples were not analyzed for TPH-P.

4.2.2 Site 5

A total of 18 soil samples were obtained from seven shallow soil borings at Site 5. Shallow monitoring wells were installed in four of the borings. Borings B05-14 and B05-15 and monitoring wells M05-06, M05-07 (installed in B05-16), M05-08, and M05-09 are located outside of Building 5, and monitoring well M05-10 is located within the building. Soil samples collected at Site 5 were analyzed for VOCs and general chemicals only; the analytical results are discussed below. Figure 4-4 presents the VOCs detected in soils at Site 5.

VOCs. Concentrations found at each sampling location are shown on Figure 4-4. Low levels of VOCs were detected at depths of 0, 2.5, or 5 feet bgs at four of the seven soil sample locations. Three of the locations are on the east side of Building 5 and the fourth location is to the west of Building 5. The VOCs detected on the east side of the building are primarily chlorinated hydrocarbon compounds, including 1,1,1-TCA, 1,1-DCA, 1,1-DCE, and TCE. Low levels of benzene, toluene and carbon disulfide were also detected on the east side of the building. Low levels of xylenes, benzene, and 1,1-DCE were detected on the west side of the building. Similar compounds at higher concentrations were detected on the east and west sides of Building 5 during the initial Phases 2B and 3 investigation.

4.2.3 Site 8

A total of nine soil samples were obtained from five locations, including three discrete surface samples (S08-01, 02, and 03) and two shallow monitoring wells (M08-06 and 07). Analytical results are discussed below. Soil findings for Site 8 are presented in Figures 4-4 and 4-5.

VOCs. Concentrations found at each sampling location are shown on Figure 4-4. Low levels of ethylbenzene and xylenes were detected in soil borings from the northeast corner (M08-06) and southwest corner of Site 8 (M08-07), from depths of either 0, 2.5, or 5 feet bgs. The VOCs and reported concentrations are consistent with previous data.

SVOCs. Concentrations found at each sampling location are shown on Figure 4-4. Low levels of PAH-related compounds were detected in one soil boring from the southwest corner of Site 8 (M08-07), at depths of 0 and 2.5-feet bgs. Past analytical results indicated elevated levels of SVOCs in a shallow soil sample collected from the northeast corner of Building 114; however, no SVOCs were detected above detection limits from the majority of vadose-zone soil samples collected during the past study.

PCBs and Pesticides. Concentrations found at each sampling location are shown on Figure 4-5. Slightly elevated levels of the PCBs Aroclor-1254 (maximum of 260 $\mu\text{g/kg}$) and Aroclor-1260 (maximum of 550 $\mu\text{g/kg}$) were detected in the three surface soil samples located northeast of Building 114 (S08-01, 02, and 03). Low levels of the pesticides 4,4'-DDT and gamma-chlordane were

detected in the boring to the east of Building 114 (M08-06) at depths of depths of 2.5 or 5 feet bgs. PCBs and pesticides were detected previously in several soil samples at similar concentrations throughout Site 8. Reported PCB concentrations were highest to the northeast of Building 114, in boring M08-04. The surface samples collected near M08-04 during this investigation indicated a decrease in PCB concentrations.

Metals. Table 4-3 summarizes metals that exceeded the 95/95 STI at Site 8. The table also identifies those metals which exceeded 10 times the STLC value.

4.2.4 Site 14

A total of 42 soil samples were obtained from 11 soil borings (B14-04 through B14-14) and nine surface soil sample locations (S14-01 through S14-09). The borings were located within the bermed area at Site 14 and the surface soil samples were located outside of the bermed area. Results of the chemical analyses for Site 14 are presented in Figures 4-6 through 4-8.

VOCs. Concentrations found at each sampling location are shown on Figure 4-6. VOCs were detected in four of the sampling locations from within the bermed area (B04-07, 09, 13, and 14), primarily from the 0-foot samples. Low levels of ethylbenzene, toluene, and xylenes were detected in two of the soil borings from the northeast and southwest ends within the bermed area (B14-07 and B14-13). Elevated levels of ethylbenzene and xylenes were detected within the southern end of the berm, in boring B14-14. Low levels of acetone were detected in boring B14-09, located within the northern end of the berm. During the previous investigation at Site 14, acetone was detected in similar concentrations at three of the four soil sample locations, and a soil gas survey indicated elevated levels of benzene, toluene, ethylbenzene, and xylenes (BTEX) within the bermed area.

TPH-P. Concentrations found at each sampling location are shown on Figure 4-7. Low levels of ethylbenzene and xylenes were detected at the same three locations and at comparable concentrations as discussed in the VOC section. Elevated levels of TPH-P compounds were detected at eight of the nine borings within the bermed area, at depths of either 0, 2.5, or 5 feet bgs. During the previous investigation, analyses were performed for total recoverable petroleum hydrocarbons (TRPH) and not TPH-P.

TPH-E. Concentrations found at each sampling location are shown on Figure 4-7. Elevated levels of TPH-E were detected in all of the soil borings, at either 0, 2.5, or 5 feet bgs. The highest concentrations were in the northern and southwestern portions of the bermed area, in borings B14-06 and B14-13, respectively. Outside of the bermed area, elevated levels of TPH-E components were detected in all of the surface soil samples; the highest concentration located west and southwest of the bermed area, in surface soil sample S14-07.

Pesticides, PCBs, and Dioxins. Concentrations found at each sampling location are shown on Figure 4-8. Pesticides, PCBs, and dioxins were detected in soil samples from Site 14. Pesticides were detected in all of the surface soil samples. Pesticide concentrations are greatest south of the bermed area, in surface soil sample S14-06. The PCB, Aroclor-1260, was detected in most of the surface soil samples; the maximum detected concentration was southeast of the bermed area, in surface soil sample S14-06. Dioxins were detected at six of the nine surface soil sample locations; dioxin levels are also greatest in the southern portion of the bermed area, in surface soil sample S14-06. Pesticide concentrations are similar to those detected during the previous investigation. The presence and levels of Aroclor-1260 are also consistent with the previous investigation findings. No analyses for dioxins were performed previously.

4.3 GROUNDWATER FLOW FINDINGS

This section presents horizontal groundwater flow information and vertical groundwater gradient information based on groundwater level measurements obtained on June 20, 1994 (the depth to groundwater measurements are presented in Table 3-8). The gradients are representative of only one quarter of groundwater level measurements, the remaining three quarters of groundwater measurements will provide adequate data for gradient characterization. The measurements obtained from each well represent the distance from the top of the well casing to the top of the water table, as measured in that well. The depth-to-water measurements were corrected with elevation survey data in order to obtain the elevation of the top of groundwater in each well. Lines drawn between each well represent an interpretation of the top of the water table at equal elevation along each line, called groundwater elevation contours. The horizontal groundwater flow will be in the direction from higher to lower groundwater elevation contours.

Groundwater contours for the first water-bearing zone were interpolated between monitoring wells which were installed in the first water-bearing zone, and groundwater contours for the second water-bearing zone were interpolated between wells installed in the second water-bearing zone. The site discussions are grouped by geographic location: Site 4; Sites 5, 8, 10A, and 12; and Site 14.

Groundwater contours for the first water-bearing zone are presented in Figures 4-9 through 4-11, and groundwater contours for the second water-bearing zone are presented in Figure 4-12.

Vertical groundwater gradients were calculated by comparing the difference in groundwater level elevations between a well installed in the first water-bearing zone and an adjacent well installed in the second water-bearing zone. For example, a net downward groundwater flow component would exist in two adjacent wells if the groundwater elevation in the second water-bearing zone well was lower than the groundwater elevation in the first water-bearing zone well. At Site 4, the second water-bearing zone is in direct contact with the first water-bearing zone, thus a difference in elevation between the two wells would suggest a gradient within the same water-bearing zone. Vertical gradient (i_v) has the following relationship:

$$\text{Vertical gradient } (i_v) = dh/dl$$

where:

dh = the difference in groundwater elevation between the shallow well (or first water-bearing zone well) and adjacent deep well (or second water-bearing zone well); and

dl = the difference between the midpoints of the screened section of the shallow well and adjacent deep well.

4.3.1 First Water-Bearing Zone

Site 4

As noted previously, the second water-bearing zone is in direct contact with the first water-bearing zone at Site 4 due to the absence of the Holocene Bay Mud layer. First water-bearing zone wells are thus referred to as "shallow" wells at Site 4 and the second water-bearing zone well is referred to as a "deep" well. Groundwater contours for the shallow wells at Site 4 are presented in Figure 4-9.

Based on the first quarter water level measurements, shallow groundwater appears to flow to the west

and northwest, with a local high groundwater elevation in the vicinity of M04-05. Groundwater measurements taken in November 1990 indicate a similar groundwater flow pattern, with groundwater flow toward the west and northwest. The vertical gradient south of Building 360 is downward based on the hydraulic heads in shallow monitoring well MW360-3 and deep monitoring well D04-01. The difference in groundwater elevations between the shallow and deep well can be seen on Figure 4-9.

Sites 5, 8, 10A, and 12

Figure 4-10 presents first water-bearing zone groundwater contours at Sites 5, 8, 10A, and 12. Groundwater contours were interpreted contiguously among Sites 5, 8, 10A, and 12 due to their proximity and similar lithology of all four sites. The groundwater in the first water-bearing zone at Sites 5, 8, 10A, and 12 appears to be significantly influenced by utilities and/or utility trenches. Locally steep gradients, as shown on Figure 4-10, may be the result of either preferential flow into the utility trenches (resulting in a "depression" in the groundwater table) or from leaking underground utilities (resulting in a mounding of the groundwater table). For example, the groundwater depressions in the vicinities of M05-05 and M12-01 are likely due to a net flow of groundwater into more permeable utility backfill (such as a sandy backfill material) or damaged utility feature (such as a cracked storm drain). Groundwater mounding, such as near M05-10 (beneath Building 5) and M08-06 may be the result of flow into the first water-bearing zone from leaking subsurface utilities, such as a leaky water line.

Generally, groundwater appears to flow almost concentrically from the southeast corner of Building 5. Southwest of the building, however, the groundwater flow direction is to the northeast toward Building 5. Previous studies at Site 5 have indicated a relatively uniform flow field trending northeast across the site. Previous water level studies at Site 10A (located on the south side of Site 5), indicated groundwater flow was to the east in August 1991 and to the southeast in December 1991. Water levels measured in June 1994 indicate groundwater flow to the northeast at Site 10A.

Contoured elevations of the groundwater surface at Site 8 generally indicate a slight trend to the northwest and northeast groundwater flow direction. September 1991 water levels, presented in the Phases 2B and 3 DSR, indicated a generally northward groundwater-flow direction. Between Sites 5

and 8, groundwater in the first water-bearing zone flows southward toward an area of low groundwater elevations on the north side of Site 12.

Groundwater flow at Site 12 appears to be north-northeast. This varies somewhat from the September 1991 water levels in the vicinity of Site 12, presented in the Phases 2B and 3 DSR, which indicated groundwater generally flowing north-northwest.

The vertical gradient directions between the first and second water-bearing zones vary in the deep wells from site to site. The vertical gradients at Site 5 are downward in the southwest portion of the site (at the M05-06/D05-03 cluster), upward in the northwest portion of the site (at the M05-01/D05-01 cluster), and downward to the east of Building 5 (at the M05-07/D05-02 cluster). At Site 10A, the vertical gradient is downward based on groundwater levels measured in M10A-02 and D10A-01. At Site 8, the vertical gradient is upward based on groundwater levels measured in M08-02 and D08-01. The vertical gradient in the southeast portion of Site 12 is upward based on hydraulic heads measured in M12-02 and D12-01.

Site 14

The first quarter groundwater levels indicate that groundwater in the first water-bearing zone flows northward at Site 14; however, groundwater flow direction at the site is tidally influenced. Based on a tidal study conducted during the 1992 investigation (PRC and JMM 1992a), the average groundwater gradient at Site 14 appears to be toward the north-northwest. Shallow groundwater gradients for the first quarter of groundwater level measurements at Site 14 are presented in Figure 4-11. Based on hydraulic heads at M14-03 and D14-01, the vertical gradient is downward from the first water-bearing zone to the second water-bearing zone at this site.

4.3.2 Second Water-Bearing Zone

The second water-bearing zone groundwater contours are based on the three deep wells at Site 5 (D05-01, 02 and 03) which are screened in the second water-bearing zone, and each respective deep well at Sites 8 (D08-01), Site 10A (D10A-01), and Site 12 (D12-01), which are screened in the second water-bearing zone. The groundwater in the second water-bearing zone flows uniformly

toward the south, as shown on Figure 4-12. Second water-bearing zone contours were not drawn for Sites 4 or 14 as there is only one well per site. Additional deep wells are planned for Site 4. Water level measurements from the additional deep wells will be utilized to assess groundwater gradients. Second water-bearing zone gradients at Site 14 will be interpolated utilizing adjacent wells from the Runway Area.

4.4 GROUNDWATER ANALYTICAL RESULTS

This section presents groundwater analytical results for the first quarter of groundwater sampling. Compounds detected above the detection limit and total dissolved solids (TDS) contours are presented in Figures 4-13 through 4-42. Metals above the detection limit, excluding the major cations (calcium, iron, magnesium, manganese, potassium, and sodium) are shown on attached figures. All compounds present above the detection limit are also tabulated in Attachment 3. The rationale for groundwater sampling locations, and the analyses that were conducted on each groundwater sample, are discussed in Section 3.0 (Tables 3-2, 3-4, and 3-6 summarize the analyses performed on groundwater samples).

Similar to the comparison of metals in soil, metals obtained from groundwater in the first water-bearing zone were also compared to the 95/95 STI for concentrations in groundwater. A map showing the location of the wells used to establish the 95/95 STI is included in Attachment 5. Because no background wells were installed in the second water-bearing zone, a statistical analysis of concentrations in groundwater from the second water-bearing zone is not available and comparisons are not made in the text. A thorough discussion of the 95/95 STI analysis is presented in the background DSR (PRC and JMM 1992a) and the Phases 5 and 6 SWAT report (PRC and Montgomery Watson 1993a). The results of the statistical analysis of metals in groundwater samples, conducted during the previous investigation, are shown on Table 4-4.

The analytical results for the first water-bearing zone are discussed first for each site, followed by the analytical results for groundwater samples obtained from the second water-bearing zone (which include second water-bearing zone wells and HydroPunch samples). The first water-bearing zone includes wells which were installed as part of this investigation, as well as previously existing wells. The analytical results of groundwater samples obtained from second water-bearing zone include groundwater samples collected from the deep well and from HydroPunch samples. HydroPunch

sampling was conducted in the second water-bearing zone and used for preliminary evaluation of groundwater quality in the second water-bearing zone.

4.4.1 Site 4

Groundwater samples were obtained from seven shallow wells and one deep well around the outside of Building 360. Four of the monitoring wells (MW360-1, 2, 3, and 4) were installed during a previous investigation and three shallow wells (M04-05, 06, and 07) and one deep well (D04-01) were installed further away from the building, as part of this investigation, to further characterize VOCs and metals in the first water-bearing zone. Deep monitoring well D04-01 was installed south of the building to monitor the groundwater quality in the second water-bearing zone. Analytical results of the groundwater sampling at Site 4 are presented in Figures 4-13 through 4-17.

First Water-Bearing Zone

VOCs. Concentrations found at each location are shown on Figure 4-13. VOCs were detected in all shallow monitoring wells at Site 4. Elevated levels of TCE, 1,2-DCE, and vinyl chloride were detected east of Building 360, in MW360-4. To the north of Building 360, in MW360-01, elevated levels of TCE were detected. Elevated levels of TCA, 1,1-DCA, 1,1-DCE, and TCE were detected west of the building in MW360-2. The remaining shallow wells indicated low levels of VOCs.

The results are similar to those from the previous investigation, with the exception of MW360-4, where concentrations of the analytes detected are approximately twice the previous concentrations. Wells that were installed further from the building during the present investigation (M04-07 and M04-06) indicate the presence of low levels of VOCs. Results of grab groundwater samples collected previously (1991) beneath the plating shop indicated low levels of 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCE, and TCE at seven sampling locations, and elevated levels of 1,1,1-TCA, 1,1-DCA, and 1,1-DCE at two of the sampling locations near the northeast corner of the plating shop.

SVOCs. SVOC concentrations found at each location are shown on Figure 4-14. SVOCs were detected at four locations. Low levels of 1,2-dichlorobenzene and 1,4-dichlorobenzene were detected north and east of the site in MW360-1 and MW360-4, respectively. Low levels of 1,2-dichloro-

benzene were detected west of the site, in MW360-2, and low levels of butylbenzylphthalate and carbazole were detected south of the building in MW360-3. The compounds detected were similar to previous investigations, except in MW360-1, where 1,2-dichlorobenzene and 1,4-dichlorobenzene were not previously detected.

Metals and Cyanide. Concentrations found at each location are shown on Figure 4-15. Cyanide was detected only in shallow monitoring well M04-05, west of the building. Table 4-5 summarizes the metals detected in groundwater around the perimeter of Building 360 which exceeded the 95/95 STI. During the previous RI/FS investigation at Site 4 in 1990, metals above the 95/95 STI were aluminum, arsenic, beryllium, copper, iron, lead, silver, and vanadium. Samples collected during the 1990 investigation were analyzed for cyanide but none was detected.

TPH-P. Concentrations found at each location are shown on Figure 4-16. Low levels of TPH-P were detected at four locations. Low levels of xylenes and slightly elevated concentrations of TPH-P as "other components," were also detected east of Building 360, in MW360-4. Groundwater was analyzed for TRPH during the previous investigation, but not TPH-P.

TPH-E. Concentrations found at each location are shown on Figure 4-16. Samples from four shallow monitoring wells contained low levels of TPH-E. During the previous investigation, groundwater was analyzed for TRPH, but not TPH-P.

Total Dissolved Solids. TDS contours are shown on Figure 4-17. TDS at Site 4 ranged from 420 to 2,500 milligrams per liter (mg/L) in shallow monitoring wells M04-06 and MW360-01, respectively.

Second Water-Bearing Zone

Due to the absence of a Holocene Bay Mud layer, there is no discernable second water-bearing zone at Site 4. Deeper groundwater samples were collected from the deep well at Site 4 and from HydroPunch samples at Site 4.

Monitoring Well. Concentrations of analytes detected in the deep well (D04-01) are shown on Figures 4-18 through 4-22. The VOC, carbon disulfide, was detected in the sample collected from

the deep well (D04-01), located at the south end of Building 360. The source of carbon disulfide is unknown.

Low levels of TPH-P and TPH-E as "other components" were detected. The TPH-P analysis also detected low levels of benzene and xylenes. A concentration of 76,000 $\mu\text{g/L}$ TDS was detected in deep well D04-01. There was no cyanide detected; the deep well was not analyzed for SVOCs or pesticide/PCBs. Metals detected above the detection limit are shown on Figure 4-20.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-18 through 4-22. Elevated levels of TCE, and low levels of 1,1-DCE and 1,2-DCE, were detected in HydroPunch sample CPT-S04-01, located north of Building 360. HydroPunch sample CPT-S04-02 (east of Building 360) contained elevated levels of 1,2-DCE, TCE and vinyl chloride, and low levels of 1,1-DCA and 1,1-DCE. The results from CPT-S04-03 (south of Building 360) indicate low levels of xylenes.

Low levels of TPH-E, and TPH-P as "other components," were detected in HydroPunch samples CPT-S04-01 and CPT-S04-02. Low levels of SVOCs (1,2-dichlorobenzene and 1,4-dichlorobenzene) were detected in HydroPunch sample CPT-S04-01. There was no cyanide detected in the HydroPunch samples. TDS in HydroPunch samples ranged from 440 to 3,000 mg/L in CPT-S04-01 and CPT-S04-03, respectively.

4.4.2 Site 5

Groundwater samples were obtained from 11 shallow wells and 3 deep groundwater wells around the outside of Building 5. Seven of the monitoring wells (M05-01, 02, 03, 04 and 05, M05BS-01, and M05HW-01) were installed during a previous investigation, and four first water-bearing zone wells (M05-06, 07, 08, 09) and three second water-bearing zone wells (D05-01, 02, and 03) were installed as part of this investigation. Results of the groundwater sampling at Site 5 are presented in Figures 4-23 through 4-26.

First Water-Bearing Zone

VOCs. Concentrations found at each location are shown on Figure 4-23. The primary VOCs detected at Site 5 were PCE, TCE, 1,2-DCE, 1,1,1-TCA, 1,1-DCA, 1,1-DCE, and vinyl chloride. Xylenes, benzene, toluene, chlorobenzene, chloroethane, and chloroform were also detected less frequently. Of the 11 wells sampled, the 2 monitoring wells to the north and northwest (M05-01 and M05-09, respectively) of the building and the well on the west-southwest side of the building (M05-06) contained only low levels of VOCs (toluene, 1,1-DCA, and 1,1-DCE). Elevated levels of TCE were detected east of Building 5 in monitoring wells M05-07, M05-08, and M05-04, and south of the Building 5 in monitoring wells M05HW-01 and M05-03. Elevated concentrations of 1,1,1-TCA were detected east of Building 5 (M05-07 and M05-04) and beneath Building 5 (M05-10). Elevated levels of vinyl chloride were detected northeast of Building 5 (M05-05), east of Building 5 (M05-04), south of Building 5 (M05HW-01 and M05-03), and west of Building 5 (M05-02). Elevated levels of xylene were detected south of Building 5 (M05-03). Low levels of benzene were detected northeast of Building 5 in monitoring well M05BS-01.

Of the five wells that were sampled as part of the earlier investigation, four wells showed similar VOC concentrations during this investigation. The fifth well, M05-03, showed an increase in VOC concentrations and had levels of TCE and vinyl chloride above the detection limit. Benzene and toluene were also detected for the first time north (M05-05 and M05BS-01) and west (M05-02) of Building 5, with a maximum benzene concentration of 2 µg/L.

SVOCs. Concentrations found at each location are shown on Figure 4-24. SVOCs were detected in six of the monitoring wells. Five of the six wells contained low concentrations of SVOCs and the sixth monitoring well (south of Building 5 in M05-03) contained higher levels of SVOCs. The five wells containing low levels of SVOCs are located around the north, east, and south perimeter of Building 5 and beneath Building 5 (M05-10). The SVOCs detected in M05-03 include 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, fluorene, naphthalene, and phenanthrene. These data are consistent with the previous investigation, except for M05-03 where different compounds and higher concentrations were reportedly detected in the groundwater samples than those collected during this quarterly groundwater sampling event.

Metals and Cyanide. Concentrations found at each location are shown on Figure 4-25. Table 4-6 summarizes the metals detected in groundwater at Site 5 which exceeded the 95/95 STI. Cyanide was detected south of Building 5 (M05-03), beneath of Building 5 (M05-10), and at the southeast corner of Building 5 (M05HW-01). The 1991 investigation identified only three metals above the 95/95 STI: aluminum, lead, and nickel. During this investigation, aluminum was not detected above the 95/95 STI. Cyanide was also detected in M05-03 during the 1991 investigation at a similar concentration.

Total Dissolved Solids. TDS contours are shown on Figure 4-26. TDS in shallow wells at Site 5 ranged from 170 mg/L in M05-10 to 5,900 mg/L in M05BS-01.

Second Water-Bearing Zone

Monitoring Wells. Concentrations of analytes detected in the second water-bearing zone wells at Site 5 (D05-01, 02, and 03) are shown on Figures 4-27, 4-29, and 4-30. Carbon disulfide was detected at low levels north, east, and west of Building 5 in monitoring wells D05-01, 02, and 03, respectively. Low levels of chloroform were detected in monitoring wells D05-01 and D05-03. Low levels of the SVOC pyrene were detected north of the building in D05-01. TDS concentrations ranged from 30,000 to 49,000 mg/L in the deep wells at Site 5. Second water-bearing zone wells were not analyzed for pesticides/PCBs, TPH, or SVOCs. There was no cyanide detected in either of the three second water-bearing zone wells. Metals present above the detection limit are shown on Figure 4-29.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-27 through 4-30. Low levels of VOCs were detected in four HydroPunch samples. CPT-S05-03, located on the east side of the building, contained low levels of 1,1-DCA, 1,1-DCE, 1,2-DCE, benzene, TCE, and vinyl chloride. Three of the HydroPunch samples obtained from around the north and northwest portions of Building 5 (CPT-S05-01, 02 and 07) contained low levels of carbon disulfide, and CPT-S05-02 contained 0.1 µg/L of benzene. Low levels of SVOCs (n-nitrosodiphenylamine) were detected in two HydroPunch samples collected at the west side of Building (CPT-S05-06 and 07). Metals above the detection limit are shown on Figure 4-29. TDS concentrations ranged from 27,000 to 41,000 mg/L in CPT-S05-02 and CPT-S05-05, respectively

4.4.3 Site 8

Groundwater samples were obtained from seven first water-bearing zone wells and one second water-bearing zone well located around the perimeter of Building 114. Five of the monitoring wells (M08-01, 02, 03, 04, and 05) were installed during a previous investigation, and two first water-bearing zone wells (M08-06 and 07) and one second water-bearing zone well (D08-01) were installed as part of this investigation. Figures 4-24, 4-26, 4-28, 4-30, 4-31, 4-32, 4-33 and 4-34 present the results of the groundwater sampling at Site 8.

First Water-Bearing Zone

VOCs. Concentrations found at each location are shown on Figure 4-31. Low levels of primarily gasoline components benzene, toluene, ethylbenzene, and xylene (BTEX) were detected in six of the seven samples from the shallow wells. Low levels of 1,2-DCE, 1,1,1-TCA, 1,1-DCA, 1,2-DCE, and TCE were detected at the southwest portion of the site. The types of VOCs and concentrations at Site 8 are consistent with data obtained from the previous investigation.

SVOCs. Concentrations found at each location are shown on Figure 4-24. Low levels of SVOCs were detected in six of the monitoring wells. Naphthalene occurred the most frequently; the highest concentration was found in well M08-01, from south of the building in M08-01. The types of SVOCs and concentrations are generally consistent with previous data, except at M08-01 where SVOC concentrations have increased since the previous investigation.

Pesticides and PCBs. None of the seven groundwater sample locations had detectable concentrations of PCBs or pesticides. Previous Site 8 groundwater data indicated low levels of bromacil and diuron at M08-05.

Metals. Concentrations found at each location are shown on Figure 4-32. Table 4-7 summarizes the metals detected in groundwater from the first water-bearing zone at Site 8 that exceed the 95/95 STI. The previous investigation at Site 8, conducted in 1991, identified only two metals at levels above the 95/95 STI: aluminum and lead. However, aluminum was not detected at similarly high levels in samples collected during the current investigation.

Total Dissolved Solids. TDS contours are shown on Figure 4-26. TDS at Site 8 ranged from 270 mg/L to 3,200 mg/L in shallow monitoring wells M08-07 and M08-05, respectively.

Second Water-Bearing Zone

Monitoring Well. Concentrations of analytes detected in the second water-bearing zone well at Site 8 (D08-01) are shown on Figures 4-28, 4-30, 4-33, and 4-34, and Figures 4-22 through 4-25. Low levels of the VOCs carbon disulfide and chloroform were detected in D08-01. A concentration of 31,000 mg/L TDS was detected in deep well D08-01. There were no SVOCs or PCB/pesticides detected; metals detected above the detection limit are shown on Figure 4-34.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-28, 4-30, 4-33, and 4-34. Low levels of benzene and carbon disulfide were detected northwest and southeast of Building 114, in HydroPunch samples CPT-S08-01 and CPT-S08-03, respectively. Low levels of benzene, toluene, and xylenes were detected southeast of Building 114 in HydroPunch sample CPT-S08-04. Low levels of n-nitrosodiphenylamine were detected southwest and southeast of Building 114 in HydroPunch samples CPT-S08-04 and CPT-S08-03, respectively. Metals above the detection limit are shown on Figure 4-34. TDS reported in HydroPunch samples ranged from 1,100 to 31,000 mg/L in CPT-S08-01 and CPT-S08-03, respectively.

4.4.4 Site 10A

Groundwater samples were collected from three previously existing first water-bearing zone wells at Site 10A and the second water-bearing zone well installed as part of this investigation (D10A-01). Additionally, shallow well M111-A, located approximately 300 feet west of Site 10A and installed during the Phases 5 and 6 investigation, is included in the Site 10A quarterly monitoring program. A summary of groundwater results by analyte group is presented below. Figures 4-24, 4-26, 4-31, and 4-32 present the results of groundwater sampling at Site 10A.

First Water-Bearing Zone

VOCs. Concentrations found at each location are shown on Figure 4-31. Low levels of VOCs were detected in three of the four shallow monitoring wells. Chloroform was detected in each of the wells, except M111-A, and chlorinated solvents (TCE, 1,2-DCE, 1,1-DCA, and 1,1-DCE) were detected in M10-01 (north of the building) and M111-A (southwest of the building). Previous shallow groundwater sampling results at Site 10A indicated that VOCs were present in only the northern portion of the site, in monitoring well M10-01. The compounds and concentrations detected previously in M10-01 are consistent with the present investigation. Low levels of 1,1-DCA and 1,1-DCE were detected in monitoring well M111-A during the previous investigation.

SVOCs. Concentrations found at each location are shown on Figure 4-24. Low levels of SVOCs were detected in only one of the four shallow wells at Site 10A. Bis(2-chloroethyl)ether and 2,2'-oxybis(1-chloropropane) were detected in monitoring well M10A-01, north of the building. As with VOCs, previous shallow groundwater sampling results indicated that SVOCs were present in only the northern portion of the site. The current groundwater monitoring results are consistent with the previous compounds and concentrations detected.

Metals. Concentrations found at each location are shown on Figure 4-32. Table 4-8 summarizes metals detected in groundwater at Site 10A which exceeded the 95/95 STI. The initial RI/FS investigation at Site 10A, conducted in 1991, identified three metals above the 95/95 STI, all of which were also detected during the current investigation.

Total Dissolved Solids. Figure 4-26 shows the TDS contours in groundwater at Site 10A. Concentrations of TDS ranged from 110 mg/L to 1,500 mg/L in shallow monitoring wells M10A-03 and M111-A, respectively.

Second Water-Bearing Zone

Monitoring Well. Concentrations of analytes detected in the second water-bearing zone well (D10A-01) are shown on Figures 4-30, 4-33, and 4-34. Low levels of the VOCs benzene, carbon disulfide, and chloroform were detected in D10A-01. A concentration of 50,000 mg/L TDS was

detected in deep well D10A-01. D10A-01 was not analyzed for SVOCs, PCB-pesticides, TPH, or cyanide. Metals detected above the detection limit are shown on Figure 4-34.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-30, 4-33, and 4-34. Low levels of carbon disulfide were detected southwest of Site 10A in HydroPunch sample CPT-S10A-01, and low levels of benzene were detected southeast of Site 10A in HydroPunch sample CPT-S10A-03. Metals above the detection limit are shown on Figure 4-34. TDS reported in HydroPunch samples ranged from 6,800 to 43,000 mg/L in CPT-S10A-04 and CPT-S10A-01, respectively.

4.4.5 Site 12

Groundwater samples were obtained from four shallow wells and one deep well around the outside of Building 10. The four first water-bearing zone wells (M12-01, 02, 03, and 04) were installed during the previous investigation and the second water-bearing zone well (D12-01) was installed as part of this investigation (CTO 0260). Results of the groundwater sampling are presented in Figures 4-24, 4-25, 4-26, 4-30, 4-31, 4-32, 4-33, 4-34 and 4-35.

First Water-Bearing Zone

VOCs. Concentrations for each location are shown on Figure 4-31. VOCs were detected in two monitoring wells. Low levels of tetrachloroethene (PCE) were detected in M12-01, north of Building 10, and low levels of benzene and toluene were detected in M12-02, northwest of Building 10. During the previous investigation, the only VOC detected was 1,2-DCE (1.6 $\mu\text{g/L}$) in well M12-02.

SVOCs. Concentrations for each location are shown on Figure 4-24. Low levels of SVOCs, (PAH compounds), were detected in monitoring well M12-02 and M12-03, northeast and south of Building 10, respectively. The types of SVOCs and concentrations are consistent with previous data.

Metals. Concentrations for each location are shown on Figure 4-25. Table 4-9 summarizes metals detected in groundwater at Site 12 which exceed the 95/95 STI. Chromium, aluminum, and lead

were detected above the 95/95 STI during the 1991 investigation. Neither aluminum nor lead were detected during the current investigation at similar levels to those previously reported.

TPH-P. Concentrations found at each location are shown on Figure 4-35. Low levels of TPH-P as toluene were detected north of Building 10 in monitoring well M12-02. During the previous investigation at Site 12, only TRPH analyses were performed.

TPH-E. Concentrations are shown on Figure 4-35. Low levels of TPH-E was detected in three of the four monitoring wells, south and northwest of Site 12.

Total Dissolved Solids. TDS contours are shown on Figure 4-26. TDS concentrations at Site 12 ranged from 290 mg/L to 2,100 mg/L in shallow monitoring wells M12-04 and M-12-03, respectively.

Second Water-Bearing Zone

Monitoring Well. Concentrations of analytes detected in the second water-bearing zone well (D12-01) are shown on Figures 4-30, 4-33, and 4-34. Low levels of 1,1,1-TCA, carbon disulfide, and chloroform were detected in D12-01. A concentration of 51,000 mg/L TDS was also detected. D12-01 was not analyzed for SVOCs, PCB-pesticides, TPH, or cyanide. Metals present above the detection limit are shown on Figure 4-34.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-28, 4-30, 4-33, and 4-34. A low level of TCE was detected in CPT-S12-01; no other VOCs were detected in HydroPunch samples. A low level of the SVOC n-nitrosodiphenylamine was detected in one HydroPunch sample (CPT-S12-04). Metals above the detection limit are shown on Figure 4-34. Results of the TDS analyses of HydroPunch samples ranged from 9,900 to 48,000 mg/L in CPT-S12-03 and CPT-S12-04, respectively.

4.4.6

Site 14

Groundwater samples were collected from three previously existing first water-bearing zone wells (M14-01, 02, and 03) and one second water-bearing zone well (D14-01) which was installed during this investigation (CTO 0260). Results of groundwater sampling at Site 14 are presented in Figures 4-36 through 4-42.

VOCs. Concentrations for each location are shown on Figure 4-36. VOCs were detected in two of the three monitoring wells at Site 14. Low levels of chloromethane were detected in monitoring well M14-03, located southwest of Site 14, and low levels of 1,1-DCA, 1,2-DCE, and carbon disulfide were detected in M14-01, located northeast of Site 14. During the previous investigation, 1,2-DCE was detected at similar concentrations in M14-01; however, VOCs were not detected previously in M14-03.

SVOCs. SVOCs were not detected in any of the monitoring wells at Site 14. These results are consistent with the previous investigation.

Metals. Concentrations for each location are shown on Figure 4-37. Table 4-10 summarizes metals detected in groundwater at Site 14 which exceeded the 95/95 STI. Chromium was the only metal detected above the 95/95 STI during the 1991 investigation, however, chromium was detected at lower concentrations (not exceeding the 95/95 STI) during the current investigation.

Pesticides and PCBs. Pesticides and PCBs were not detected in any of the shallow or deep monitoring wells at Site 14. This is consistent with the previous investigation.

TPH-P. TPH-P components were not detected in any of the shallow monitoring wells at Site 14. Analyses for TPH-P were not performed during the previous investigation.

TPH-E. Concentrations found at each location are shown on Figure 4-38. TPH-E components were detected in each of the three first water-bearing zone monitoring wells, and a slightly elevated concentration was found in monitoring well M14-01 (the northeast area of Site 14). Analyses for TPH-E were not performed during the previous investigation.

Total Dissolved Solids. TDS contours are shown on Figure 4-39. TDS at Site 14 ranged from 860 mg/L to 2,300 mg/L in shallow monitoring wells M14-02 and M-14-03, respectively. As expected, the TDS levels increase toward the Oakland Inner Harbor.

Second Water-Bearing Zone

Monitoring Well. Concentrations of analytes detected in the second water-bearing zone well (D14-01) found at each location are shown on Figures 4-40 through 4-42. Low levels of 1,1,1-TCA, 1,2-DCE, carbon disulfide, and chloroform were present in monitoring well D14-01, and a concentration of 35,000 mg/L TDS was detected. D14-01 was not analyzed for SVOCs, PCB-pesticides, TPH, or cyanide. Metals present above the detection limit are shown on Figure 4-41.

HydroPunch. Concentrations of analytes found at each location are shown on Figures 4-40 and 4-42. There were no VOCs or SVOCs detected in HydroPunch samples. TDS detected in HydroPunch samples ranged from 22,000 to 23,000 mg/L in CPT-S14-01 and CPT-S14-03, respectively. Metals above the detection limit are shown on Figure 4-41.

4.5 NON-POINT SOURCE SAMPLING RESULTS

No NPS samples were collected in past investigations. The NPS data collected under CTO 260 and presented here, as well as other NPS data from other NAS Alameda IRP sites, including the environmental baseline survey contractor investigations, will be used for assessment of the effective transport of the stormwater system and its potential as a contamination source. The rationale for sample locations and the analyses that were conducted on each sample are discussed in Section 3.0 (Table 3-7 summarizes the analyses performed on NPS samples).

The findings of the NPS sampling program are presented in the following subsections by site. The results are presented on Figure 4-43 for Site 4; Figure 4-44 for Sites 5, 8, 10A, and 12; and Figure 4-45 for Site 14. For metals, the figures show only the major cations (as discussed in the opening paragraph to Section 4.0) having concentrations above 10 times the STLC value. Attachment 4 lists the STLC values and describes the rationale for this screening method. The tables in Attachment 3 include all analytes detected. In general, VOCs, SVOCs, petroleum hydrocarbons, and metals were

detected at elevated concentrations compared to concentrations detected in either soil or groundwater samples.

4.5.1 Site 4

Three NPS sediment samples were collected at Site 4. The locations of these samples are shown on Figure 4-43. The primary compounds detected in the NPS samples at Site 4 were SVOCs, petroleum hydrocarbons, cyanide, and metals. Analytical results of the NPS samples follow.

NPS-S04-01. This sample was collected from the storm drain catch basin located downgradient of the oil and water separator situated on the east side of Building 360. This location was selected to assess the potential discharge from floor drains located within Building 360. NPS-S04-01 also receives off-site discharge from either north or south of Building 360. Analytes detected at NPS-S04-01 include the following:

- One VOC (chlorobenzene)
- Metals detected above 10 times the STLC - cadmium, chromium (assuming total chromium is all hexavalent), lead, and nickel. Nickel, detected at 3,130 mg/kg, is also above the total threshold limit concentration (TTLC) value.
- Cyanide
- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P (other components)

NPS-S04-02. This sample was collected from a storm drain manhole located outside the northwest corner of Building 360. The manhole is downgradient of building discharges. Analytes detected at NPS-S04-02 include the following:

- Three VOCs: 1,2-DCE, chlorobenzene, and trichloroethene
- Ten SVOCs: 1,4-dichlorobenzene, 2-methylnaphthalene, 2-methylphenol, 4-methylphenol, bis(2-ethylhexyl)phthalate, dibenzofuran, fluoranthene, naphthalene, phenol, and pyrene

- Metals detected above 10 times the STLC value - cadmium, chromium (assuming total chromium is all hexavalent), copper, nickel, and silver. Nickel (at 7,430 mg/kg) was detected above the TTLC value.
- Cyanide
- TPH-E as motor oil (C₁₆-C₃₂) and other components of TPH-E
- TPH-P (other components)

NPS-S04-03. This sample was collected from a catch basin located near the southwest corner of Building 360. The catch basin is located downgradient of discharges from the western part of the building. The analytes detected at NPS-S04-03 include the following:

- Two VOCs: 1,2-DCE and ethylbenzene
- Two SVOCs: 2-methylnaphthalene and fluoranthene
- Metals detected above 10 times the STLC - cadmium, chromium (assuming total chromium is all hexavalent), copper, lead, nickel, and silver. Nickel, detected at 1,720 mg/kg, is an order of magnitude greater than the STLC.
- Cyanide
- TPH-E as JP-5 (C₈-C₁₆) and as motor oil (C₁₆-C₃₂)
- TPH-P (other components)

4.5.2 Site 5

Based on the location of storm, sanitary, and industrial sewer lines shown on utility maps of NAS Alameda, four NPS sediment samples were collected at Site 5. The locations and concentrations of these samples are shown on Figure 4-44. The primary compounds detected in the NPS samples at Site 5 were VOCs, SVOCs, petroleum hydrocarbons, and metals.

NPS-S05-01. This sample was collected from a storm drain manhole located east of Building 5. The manhole is located downgradient of a catch basin near a solvent tank and grease trap. The analytes detected in NPS-S05-01 include the following:

- Ten VOCs - elevated levels compared to VOCs detected in soil at Site 5: 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCE, chloroethane, PCE, toluene, TCE, vinyl chloride, and xylenes.
- Five SVOCs: 2-methylnaphthalene, dibenzofuran, fluorene, N-nitroso-diphenylamine, and phenanthrene
- Metals above 10 times the STLC - cadmium, chromium (assuming total chromium is all hexavalent), copper, lead (above TTLC), mercury, and silver.
- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P as toluene, total xylenes, and other components

NPS-S05-02. This sample was collected from a storm drain manhole located west of Building 5. The manhole was selected because it is located downgradient of a main Building 5 discharge and catch basin located between Buildings 44 and 347. Analytes detected at NPS-S05-02 include the following:

- Five VOCs - low levels compared to NPS-S05-01: 1,1-DCA, 1,2-DCE, ethylbenzene, TCE, and vinyl chloride
- Two SVOCs: fluoranthene and pyrene
- Metals above 10 times the STLC value - chromium (assuming total chromium is all hexavalent) and lead
- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P (other components)

NPS-S05-03. This sample was collected from a storm drain manhole located southwest of Building 5. The manhole is located downgradient of the storm drain discharges from the southwest corner of Building 5 and a grease trap. The analytes detected in NPS-S05-03 include the following:

- Fifteen SVOCs: acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene

- Metals above 10 times the STLC value - cadmium, chromium (assuming total chromium is all hexavalent), copper, and lead
- TPH-E (other components)
- TPH-P (other components)

NPS-S05-04. This sample was collected from a storm drain manhole located near the northwest corner of Building 5. The manhole was selected because it is located downgradient of the storm drain discharges from the north side of the building. Analytes detected in NPS-S05-04 include the following:

- Two SVOCs: benzo(b)fluoranthene and pyrene
- Metals above 10 times the STLC - copper and lead
- TPH-E as motor oil (C₁₆-C₃₂)

4.5.3 Site 8

Based on the location of storm, sanitary, and industrial sewer lines shown on utility maps of Building 114, two NPS sediment samples were collected at Site 8. Figure 4-45 presents the locations and analytical results for Site 8 NPS samples.

NPS-S08-01. This sample was collected from the storm drain manhole located southwest of Building 114. This location was selected to assess the downgradient discharges along the southern wing of Building 114. The analytes detected in NPS-S08-01 include the following:

- Nine VOCs - 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCE, carbon disulfide, chloroform, toluene, TCE, and vinyl chloride
- Metals above 10 times the STLC - chromium (assuming total chromium is all hexavalent), copper, lead, and mercury
- Pesticides
- PCBs

- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P as toluene and other components

NPS-S08-02. This sample was collected from the storm drain manhole located northeast of Building 114. This location was selected to assess the downgradient discharges of the catch basins draining the central courtyard of Building 114. The analytes detected in NPS-S08-02 include the following:

- Two SVOCs: fluoranthene and pyrene
- Pesticides
- PCBs
- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P (other components)
- Metals above 10 times the STLC - lead and mercury

4.5.4 Site 10A

At Site 10A, two NPS sediment sample locations were selected based on the location of storm, sanitary, and industrial sewer lines shown on utility maps. Figure 4-43 presents the NPS locations and results of the analyses.

NPS-S10A-01. This sample was collected from the storm drain manhole located downgradient of Building 400. The analytes detected in NPS-S10A-01 include the following:

- One VOC (chloroform)
- Seven SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene
- Metals above 10 times the STLC - lead
- TPH-E as motor oil (C₁₆-C₃₂)

NPS-S10A-02. This sample was collected from the storm drain manhole downgradient of the discharges from the north side of Building 400 and a grease trap near the northwest corner of the building. The analytes detected in NPS-S10A-02 include the following:

- 12 VOCs: 1,1,1-TCA, 1,1-DCA, 1,2-DCA, 1,2-DCE, carbon disulfide, chloroform, ethylbenzene, PCE, toluene, TCE, vinyl chloride, and xylenes
- Seven SVOCs: 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, fluoranthene, n-nitroso-diphenylamine, naphthalene, phenanthrene, and pyrene
- Metals above 10 times the STLC - cadmium, copper, lead (above the TTLC), and mercury
- TPH-E as kerosene (C₈-C₁₈) and other components
- TPH-P as ethylbenzene, toluene, xylenes, and other components

4.5.5 Site 12

Based on the location of storm, sanitary, and industrial sewer lines shown on utility maps of Building 10, three NPS sediment samples were collected at Site 12. Figure 4-43 presents the NPS locations and results of the analyses.

NPS-S12-01. This sample was collected from the storm drain catch basin located near the southeast corner of Building 10. This catch basin is downgradient of discharges from the southeast corner of the site. The analytes detected in NPS-S12-01 include the following:

- Six SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene
- TPH-E as motor oil (C₁₆-C₃₂)
- Metals above ten times the STLC - barium and lead

NPS-S12-02. This sample was collected from the storm drain catch basin located near the southwest corner of Building 10. This catch basin is downgradient of discharges from the southwestern corner of the site. The analytes detected in NPS-S12-02 include the following:

- Metals above 10 times the STLC - barium, copper, and lead
- TPH-E (other components)

NPS-S12-03. This sample was collected from the storm drain manhole located northeast of Building 10. This manhole is downgradient of the discharges from the north side of the building. The analytes detected in NPS-S12-03 include the following:

- Three SVOCs: chrysene, fluoranthene, and pyrene
- Metals above 10 times the STLC - chromium, copper, and lead (above the TTLC)
- TPH-E as motor oil (C₁₆-C₃₂) and other components
- TPH-P (other components)

4.5.6 Site 14

A sump used for the collection of runoff from fire training activities is located in the northeast corner of the fire training concrete pad. NPS sample NPS-S14-01 was collected from this sump which drains the fire training area concrete pad. The sample location was selected to assess the presence of contaminated runoff from the fire training area. Below is a summary of the analytes detected. Figure 4-44 presents the results of the analyses.

- Metals above 10 times the STLC - chromium (assuming total chromium is all hexavalent), barium, cadmium, and lead
- TPH-E as motor oil (C₁₆-C₃₂) and other components

TABLE 4-1

**CTO 260 NAS ALAMEDA
STATISTICAL ANALYSIS OF METALS RESULTS FOR SOIL SAMPLES^a**

Metals	Average Concentration	Standard Deviation	Statistical Tolerance Factor	95 Percent/95 Percent STI ^b	
				Lower Limit (mg/kg) ^c	Upper Limit (mg/kg)
Aluminum	7,590	3,950	2.87	0	18,900
Antimony	4.34	0.43	2.87	3.10	5.58
Arsenic	2.15	0.92	2.87	0	480
Barium	50.9	20.8	2.87	0	111
Beryllium	0.38	0.17	2.87	0	0.87
Cadmium	0.48	0.10	2.87	0.19	0.76
Calcium	3,280	1,210	2.87	0	6,740
Chromium	34.5	10.4	2.87	4.59	64.3
Cobalt	4.66	2.16	2.87	0	10.9
Copper	10.8	7.74	2.87	0	33.0
Iron	12,500	5,420	2.87	0	28,000
Lead	15.8	15.8	2.87	0	61.1
Magnesium	3,290	1,860	2.87	0	8,610
Manganese	160	79.8	2.87	0	390
Mercury	0.08	0.15	2.87	0	0.50
Nickel	28.1	10.3	2.87	0	57.6
Potassium	1,070	459	2.87	0	2,390
Selenium	0.29	0.27	2.87	0	1.07
Silver	0.56	0.06	2.87	0.39	0.73
Sodium	475	264	2.87	0	1,230
Thallium	0.19	0.02	2.87	0.13	0.25
Vanadium	28.4	10.9	2.87	0	59.7
Zinc	53.2	71.0	2.87	0	257

Source: PRC/JMM, 1992c

^a Statistical analysis conducted during previous investigation.

^b Tolerance Interval = Average \pm (Standard Deviation x Statistical Tolerance Factor) (Taylor 1990)

^c Negative concentrations are rounded to zero.

STI - Statistical Tolerance Interval

TABLE 4-2

**CTO 260 NAS ALAMEDA
METALS IN SOIL EXCEEDING 95 PERCENT/95 PERCENT STI
OR 10 TIMES STLC AT SITE 4**

Location	Sample Location (depth - ft bgs)	Metal	Soil Concentration Exceeding 95 Percent/95 Percent STI (mg/kg) ^a	Soil Concentration Exceeds 10 Times STLC (Yes or No) ^b
Site 4	B04-22-2.5	Copper	65.2	No
		Silver	1.7	No
	B04-42-0.0	Cadmium	5.9	No
		Chromium	134 J ^c	No
		Copper	33.5 J	No
		Nickel	90.0 J	No
		Silver	15.1	No
	B04-42-2.5	Cadmium	4.3	No
		Chromium	70.5 J	No
		Silver	1.1	No
	B04-42-5.0	Cadmium	1.5	No
		Chromium	157 J	No
		Cobalt	12.2 J	No
		Nickel	115 J	No
	M04-07-5.0	Arsenic	24.8 J	No
		Barium	111	No
		Cadmium	1.1	No
		Copper	96.5	No
		Lead	243	Yes
		Manganese	864	No
		Mercury	0.53	No
		Nickel	59	No
		Selenium	9.6 J	No

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the soil samples are expected to fall 95 percent of the time, based on previous soil samples collected at NAS Alameda from areas of non-industrial use.

^b For the purpose of a screening criteria for this document, soil concentrations have been compared to a value equal to 10 times the STLC.

^c J - Estimated Concentration

STI - Statistical Tolerance Interval

STLC - Solubility Threshold Limit Concentration

TABLE 4-3

**CTO 260 NAS ALAMEDA
METALS IN SOIL EXCEEDING 95 PERCENT/95 PERCENT STI
OR 10 TIMES STLC AT SITE 8**

Location	Surface Soil Sample Location	Metal	Soil Concentration Exceeding 95 Percent/95 Percent STI (mg/kg) ^a	Soil Concentration Exceeds 10 Times STLC (mg/kg) ^b
Site 8	S08-01	Barium	125 J ^c	No
		Cadmium	2.3	No
		Chromium	154 J	No
		Copper	35.7 J	No
		Lead	301	Yes
		Nickel	59.1 J	No
		Zinc	280 J	No
	S08-02	Cadmium	1.8	No
		Chromium	80.7 J	No
		Lead	123	Yes
	S08-03	Cadmium	3.4	No
		Chromium	162 J	No
		Copper	38.9 J	No
		Lead	363	Yes
		Zinc	781 J	No

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the soil samples are expected to fall 95 percent of the time, based on previous soil samples collected at NAS Alameda from areas of non-industrial use.

^b For the purpose of a screening criteria for this document, soil concentrations have been compared to a value equal to 10 times the STLC.

^c J - Estimated Concentration

STI - Statistical Tolerance Interval

STLC - Solubility Threshold Limit Concentration

TABLE 4-4
CTO 260 NAS ALAMEDA
STATISTICAL ANALYSIS OF METALS RESULTS FOR GROUNDWATER SAMPLES

Metals	Average Concentration	Standard Deviation	Statistical Tolerance Factor	95 Percent/95 Percent STI ^a	
				Lower Limit (µg/L) ^b	Upper Limit (µg/L)
Aluminum	29.9	19.2	6.37	0	152
Antimony	23.5	9.6	6.37	0	84.5
Arsenic	4.7	5.0	6.37	0	36.3
Barium	245	292	6.37	0	2,100
Beryllium	1.3	0	6.37	1.3	1.3
Cadmium	2.0	0	6.37	2.0	2.0
Calcium	83,500	39,600	6.37	0	336,000
Chromium	3.2	0	6.37	3.2	3.2
Cobalt	8.6	0	6.37	8.6	8.6
Copper	3.8	3.8	6.37	0	27.7
Iron	1,110	1,270	6.37	0	9,200
Lead	1.0	0	6.37	1.0	1.0
Magnesium	111,000	148,000	6.37	0	1,050,000
Manganese	892	682	6.37	0	5,240
Mercury	0.1	0	6.37	0.1	0.1
Nickel	6.6	0	6.37	6.6	6.6
Potassium	40,200	42,200	6.37	0	309,000
Selenium	1.0	0	6.37	1.0	1.0
Silver	2.4	0	6.37	2.4	2.4
Sodium	235,000	336,000	6.37	0	2,380,000
Thallium	0.9	0	6.37	0.9	0.9
Vanadium	10.9	9.4	6.37	0	70.7
Zinc	4.0	3.4	6.37	0	25.7

Source: PRC/JMM, 1992c

^a Tolerance Interval = Average \pm (Standard Deviation x Statistical Tolerance Factor) (Taylor 1990)

^b Negative concentrations are rounded to zero.

STI - Statistical Tolerance Interval

TABLE 4-5

**CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 4**

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
Site 4	MW360-01	Cobalt Nickel	19.7 J ^b 1340
	MW360-02	Nickel	9.7
	MW360-03	Nickel	25.1
	MW360-04	Nickel	10.2
	M04-05	Chromium	789
	M04-05	Nickel	15.8
		Selenium	3.4 J
	CPT-S4-01	Cobalt	12.8 J
		Nickel	1550
	CPT-S4-03	Cobalt	13.9 J
	D04-01	Manganese	8100 J
		Zinc	103 J

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

^b J - Estimated Concentration

STI - Statistical Tolerance Interval

TABLE 4-6

CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 5

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
Site 5	M05-03	Arsenic Lead Nickel Selenium	69.1 3.2 161 J 24.3
	M05-04	Lead Nickel Selenium	1.6 J 9.0 J 28.1
	M05-05	Nickel	7.6 J
	M05-06	Thallium	20.0 J
	M05-07	Lead Nickel Selenium	1.4 J 15.4 J 16.1
	M05-08	Arsenic Lead Selenium	43.6 1.3 J 14.1
	M05-10	Chromium	15.1
	M05BS-01	Nickel	63.8
	M05HW-01	Nickel Selenium	27.5 J 11.8
	CPT-S5-01	Lead Silver Selenium	154 J 3.6 77.3
	CPT-S5-02	Lead Silver	20.2 2.7
	CPT-S5-03	Lead Manganese Silver	27.8 J 8680 2.6

TABLE 4-6

CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 5
(Continued)

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
	CPT-S5-04	Chromium	11.3
		Cobalt	62.4
		Copper	38.5
		Manganese	25500
		Nickel	50.8
		Silver	6.3
	CPT-S5-05	Cadmium	5.3 J
		Cobalt	67.5
		Manganese	31500
		Nickel	51.6
		Silver	5.1
	CPT-S5-06	Cobalt	13.8 J
		Manganese	9060
	CPT-S05-07	Zinc	87.3
	D05-01	Cadmium	4.0 J
		Cobalt	11.9 J
		Nickel	15.4 J
		Zinc	303
	D05-02	Lead	12.8 J
		Manganese	5650 J
		Nickel	17.0 J
		Zinc	82.5 J
	D05-03	Beryllium	2.6 J
		Cadmium	2.1 J
		Cobalt	21.6 J
		Nickel	30.8 J
		Zinc	140 J

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

^b J - Estimated Concentration

STI - Statistical Tolerance Interval

TABLE 4-7

CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 8

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a ($\mu\text{g/L}$)
Site 8	M08-01	Selenium	15.0
	M08-02	Selenium	13.9
	M08-03	Selenium	8.1
	M08-04	Mercury Selenium	0.11 10.1
	M08-05	Selenium	7.5
	M08-06	Mercury Selenium	0.11 3.3 J ^b
	M08-07	Mercury Selenium	0.13 3.2 J
	CPT-S08-01	Cobalt Copper Manganese Nickel Silver	46.3 J 28.2 14600 38.3 5.4
	CPT-S08-03	Barium Chromium Silver	2450 4.9 J 4.4
	CPT-S08-04	Chromium Cobalt Lead Manganese Nickel Silver	4.3 J 20.3 J 4.6 11600 34.5 3.3
	CPT-S08-04DUP	Cobalt Lead Manganese Nickel Selenium Silver	21.9 J 5.7 11400 28.4 61.6 5.0

TABLE 4-7

CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 8
(Continued)

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
	D08-01	Cadmium	5.0
		Cobalt	11.7 J
		Manganese	9410
		Nickel	19.9
		Selenium	11.1
		Zinc	185

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

^b J - Estimated Concentration

STI - Statistical Tolerance Interval

TABLE 4-8

CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 10A

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
Site 10A	M10A-01	Nickel Selenium	118 3.9 J ^b
	M10A-02	Chromium	4.5 J
	M10A-03	Aluminum	176
	M111-A	Selenium	7.0
	CPT-S10A-01	Manganese	16000
	CPT-S10A-02	Cobalt Manganese	14.2 J 13600
	CPT-S10A-03	Lead Nickel	4.7 13.2
	CPT-S10A-04	Lead	2.4 J
	D08-01	Beryllium Cadmium Chromium Cobalt Manganese Mercury Nickel Selenium Zinc	1.7 J 6.9 6.0 J 24.0 J 15600 0.11 23.9 13.2 333

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

^b J - Estimated Concentration

STI - Statistical Tolerance Interval

TABLE 4-9

**CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 12**

Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
Site 12	M12-01	Nickel	10.9
	M12-02	Chromium	4.4 J ^b
	CPT-S12-03 Dup	Nickel	7.0
	CPT-S12-04	Nickel	7.0
	D12-01	Beryllium Cadmium Chromium Cobalt Manganese Nickel Zinc	2.8 J 5.6 J 3.4 J 11.6 J 10700 17.3 J 828

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

^b J - Estimated Concentration

STI - Statistical Tolerance Interval

TABLE 4-10

**CTO 260 NAS ALAMEDA
METALS IN GROUNDWATER EXCEEDING 95 PERCENT/95 PERCENT STI AT SITE 14**

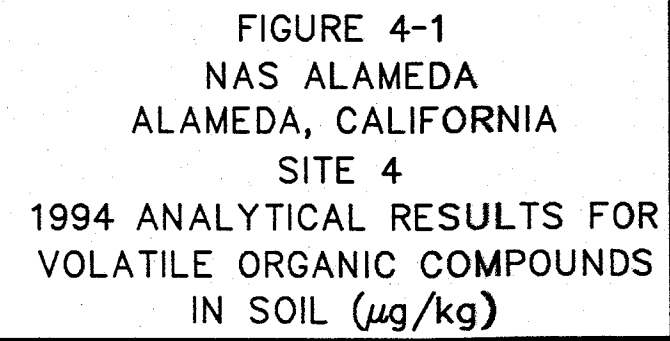
Location	Sample Location	Metal	Groundwater Concentration Exceeding 95 Percent/95 Percent STI ^a (µg/L)
Site 14	M14-01	Lead Selenium	1.1 J ^b 21.2
	M14-02	Lead Mercury Selenium	1.5 J 0.86 J 33.3
	M14-03	Lead Selenium	1.3 J 13.3
	CPT-S14-01	Lead Manganese Mercury Zinc	2.6 J 11600 0.15 66.2
	CPT-S14-03	Cobalt Lead Manganese Selenium	9.8 J 1.4 J 6210 27.8 J
	D14-01	Cadmium Selenium Zinc	2.6 J 19.5 J 53.5 J

Note:

^a This is a 95 percent/95 percent STI, where 95 percent of the groundwater samples are expected to fall 95 percent of the time, based on previous groundwater samples collected from NAS Alameda from areas of non-industrial use.

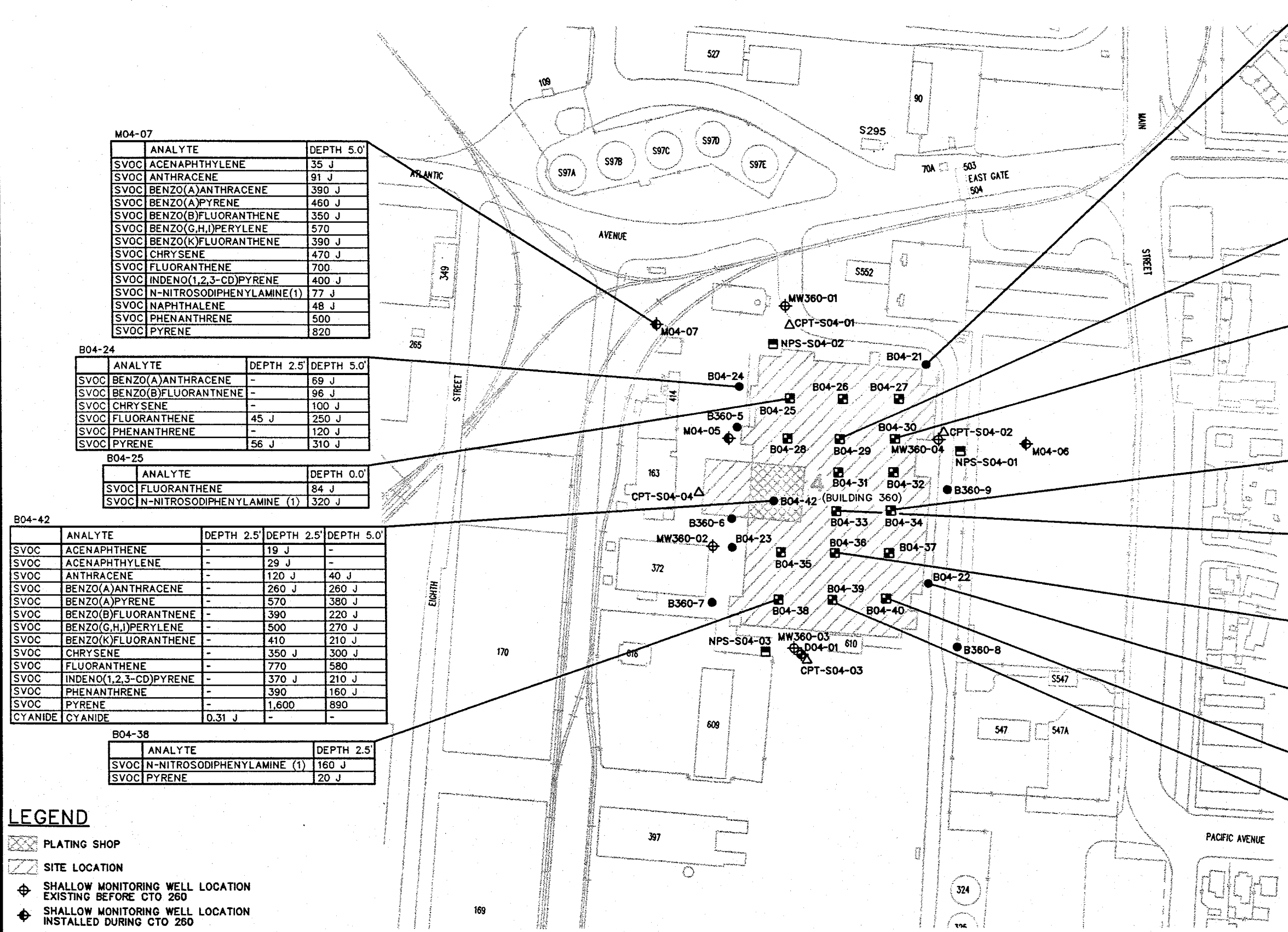
^b J - Estimated Concentration

STI - Statistical Tolerance Interval





FILE NAME: E:\ALAMEDA\HITMAP.DWG
DN
DATE: 01/25/95



M04-07

	ANALYTE	DEPTH 5.0'
SVOC	ACENAPHTHYLENE	35 J
SVOC	ANTHRACENE	91 J
SVOC	BENZO(A)ANTHRACENE	390 J
SVOC	BENZO(A)PYRENE	460 J
SVOC	BENZO(B)FLUORANTHENE	350 J
SVOC	BENZO(G,H,I)PERYLENE	570
SVOC	BENZO(K)FLUORANTHENE	390 J
SVOC	CHRYSENE	470 J
SVOC	FLUORANTHENE	700
SVOC	INDENO(1,2,3-CD)PYRENE	400 J
SVOC	N-NITROSODIPHENYLAMINE (1)	77 J
SVOC	NAPHTHALENE	48 J
SVOC	PHENANTHRENE	500
SVOC	PYRENE	820

B04-24

	ANALYTE	DEPTH 2.5'	DEPTH 5.0'
SVOC	BENZO(A)ANTHRACENE	-	69 J
SVOC	BENZO(B)FLUORANTHENE	-	96 J
SVOC	CHRYSENE	-	100 J
SVOC	FLUORANTHENE	45 J	250 J
SVOC	PHENANTHRENE	-	120 J
SVOC	PYRENE	56 J	310 J

B04-25

	ANALYTE	DEPTH 0.0'
SVOC	FLUORANTHENE	84 J
SVOC	N-NITROSODIPHENYLAMINE (1)	320 J

B04-42

	ANALYTE	DEPTH 2.5'	DEPTH 2.5'	DEPTH 5.0'
SVOC	ACENAPHTHYLENE	-	19 J	-
SVOC	ACENAPHTHYLENE	-	29 J	-
SVOC	ANTHRACENE	-	120 J	40 J
SVOC	BENZO(A)ANTHRACENE	-	260 J	260 J
SVOC	BENZO(A)PYRENE	-	570	380 J
SVOC	BENZO(B)FLUORANTHENE	-	390	220 J
SVOC	BENZO(G,H,I)PERYLENE	-	500	270 J
SVOC	BENZO(K)FLUORANTHENE	-	410	210 J
SVOC	CHRYSENE	-	350 J	300 J
SVOC	FLUORANTHENE	-	770	580
SVOC	INDENO(1,2,3-CD)PYRENE	-	370 J	210 J
SVOC	PHENANTHRENE	-	390	160 J
SVOC	PYRENE	-	1,600	890
CYANIDE	CYANIDE	0.31 J	-	-

B04-38

	ANALYTE	DEPTH 2.5'
SVOC	N-NITROSODIPHENYLAMINE (1)	160 J
SVOC	PYRENE	20 J

B04-21

	ANALYTE	DEPTH 2.5'	DEPTH 5.0'
SVOC	ACENAPHTHYLENE	-	170 J
SVOC	ACENAPHTHYLENE	-	28 J
SVOC	ANTHRACENE	-	450
SVOC	BENZO(A)ANTHRACENE	-	1,100
SVOC	BENZO(A)PYRENE	-	1,500
SVOC	BENZO(B)FLUORANTHENE	-	960
SVOC	BENZO(G,H,I)PERYLENE	-	1,000
SVOC	BENZO(K)FLUORANTHENE	-	870
SVOC	CHRYSENE	-	1,200
SVOC	FLUORANTHENE	-	2,600
SVOC	FLUORENE	-	71 J
SVOC	INDENO(1,2,3-CD)PYRENE	-	750
SVOC	PHENANTHRENE	-	1,100
SVOC	PYRENE	-	3,600 J

B04-29

	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
SVOC	BENZO(A)PYRENE	58 J	-
SVOC	FLUORANTHENE	23 J	-
SVOC	N-NITROSODIPHENYLAMINE (1)	73 J	-
SVOC	PYRENE	44 J	16 J

B04-30

	ANALYTE	DEPTH 2.5'
SVOC	BENZO(A)ANTHRACENE	18 J
SVOC	FLUORANTHENE	45 J
SVOC	PHENANTHRENE	32 J
SVOC	PYRENE	52 J

B04-34

	ANALYTE	DEPTH 2.5'
SVOC	BENZO(B)FLUORANTHENE	56 J
SVOC	FLUORANTHENE	52 J
SVOC	PYRENE	80 J

B04-33

	ANALYTE	DEPTH 0.0'
SVOC	BENZO(A)PYRENE	58 J
SVOC	BENZO(B)FLUORANTHENE	82 J
SVOC	FLUORANTHENE	60 J
SVOC	PYRENE	100 J

B04-36

	ANALYTE	DEPTH 2.5'
SVOC	FLUORANTHENE	24 J
SVOC	PYRENE	57 J

B04-22

	ANALYTE	DEPTH 2.5'
SVOC	FLUORANTHENE	50 J
SVOC	PYRENE	55 J

B04-40

	ANALYTE	DEPTH 2.5'
SVOC	PYRENE	38 J

B04-39

	ANALYTE	DEPTH 2.5'
CYANIDE	CYANIDE	0.39 J

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

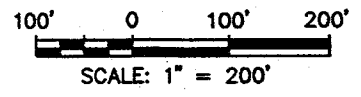
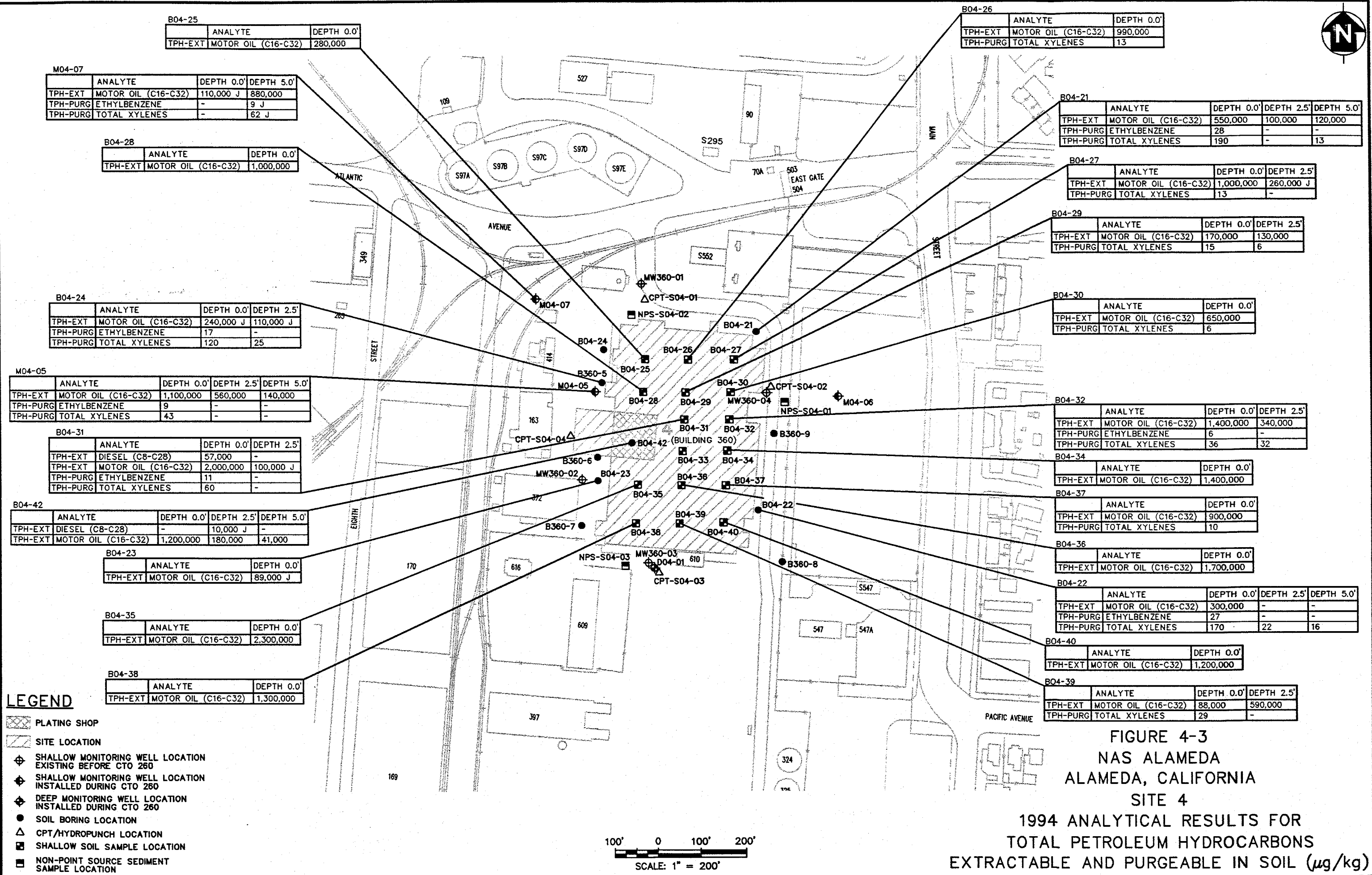


FIGURE 4-2
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
SEMIVOLATILE ORGANIC COMPOUNDS ($\mu\text{g/kg}$)
AND CYANIDE (mg/kg) IN SOIL

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DN
DATE: 01/25/95



B04-25		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	280,000

B04-26		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	990,000
TPH-PURG	TOTAL XYLENES	13

M04-07			
	ANALYTE	DEPTH 0.0'	DEPTH 5.0'
TPH-EXT	MOTOR OIL (C16-C32)	110,000 J	880,000
TPH-PURG	ETHYLBENZENE	-	9 J
TPH-PURG	TOTAL XYLENES	-	62 J

B04-28		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,000,000

B04-21				
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'	DEPTH 5.0'
TPH-EXT	MOTOR OIL (C16-C32)	550,000	100,000	120,000
TPH-PURG	ETHYLBENZENE	28	-	-
TPH-PURG	TOTAL XYLENES	190	-	13

B04-27			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	MOTOR OIL (C16-C32)	1,000,000	260,000 J
TPH-PURG	TOTAL XYLENES	13	-

B04-24			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	MOTOR OIL (C16-C32)	240,000 J	110,000 J
TPH-PURG	ETHYLBENZENE	17	-
TPH-PURG	TOTAL XYLENES	120	25

B04-29			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	MOTOR OIL (C16-C32)	170,000	130,000
TPH-PURG	TOTAL XYLENES	15	6

B04-30		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	650,000
TPH-PURG	TOTAL XYLENES	6

M04-05				
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'	DEPTH 5.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,100,000	560,000	140,000
TPH-PURG	ETHYLBENZENE	9	-	-
TPH-PURG	TOTAL XYLENES	43	-	-

B04-32			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	MOTOR OIL (C16-C32)	1,400,000	340,000
TPH-PURG	ETHYLBENZENE	6	-
TPH-PURG	TOTAL XYLENES	36	32

B04-31			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	DIESEL (C8-C28)	57,000	-
TPH-EXT	MOTOR OIL (C16-C32)	2,000,000	100,000 J
TPH-PURG	ETHYLBENZENE	11	-
TPH-PURG	TOTAL XYLENES	60	-

B04-34		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,400,000

B04-42				
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'	DEPTH 5.0'
TPH-EXT	DIESEL (C8-C28)	-	10,000 J	-
TPH-EXT	MOTOR OIL (C16-C32)	1,200,000	180,000	41,000

B04-37		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	900,000
TPH-PURG	TOTAL XYLENES	10

B04-23		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	89,000 J

B04-36		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,700,000

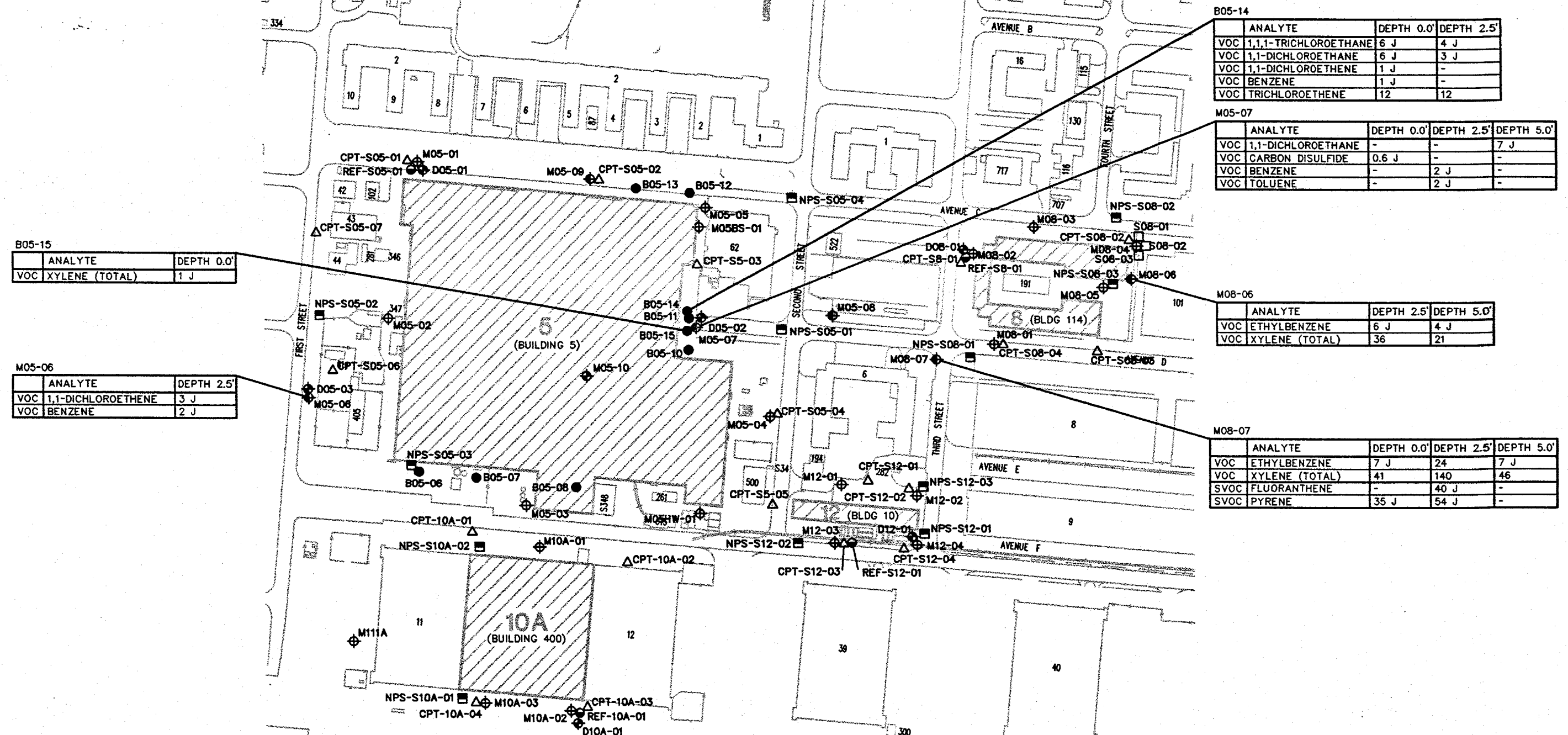
B04-35		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	2,300,000

B04-22				
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'	DEPTH 5.0'
TPH-EXT	MOTOR OIL (C16-C32)	300,000	-	-
TPH-PURG	ETHYLBENZENE	27	-	-
TPH-PURG	TOTAL XYLENES	170	22	16

B04-38		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,300,000

B04-40		
	ANALYTE	DEPTH 0.0'
TPH-EXT	MOTOR OIL (C16-C32)	1,200,000

B04-39			
	ANALYTE	DEPTH 0.0'	DEPTH 2.5'
TPH-EXT	MOTOR OIL (C16-C32)	88,000	590,000
TPH-PURG	TOTAL XYLENES	29	-



LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

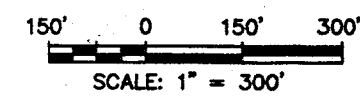
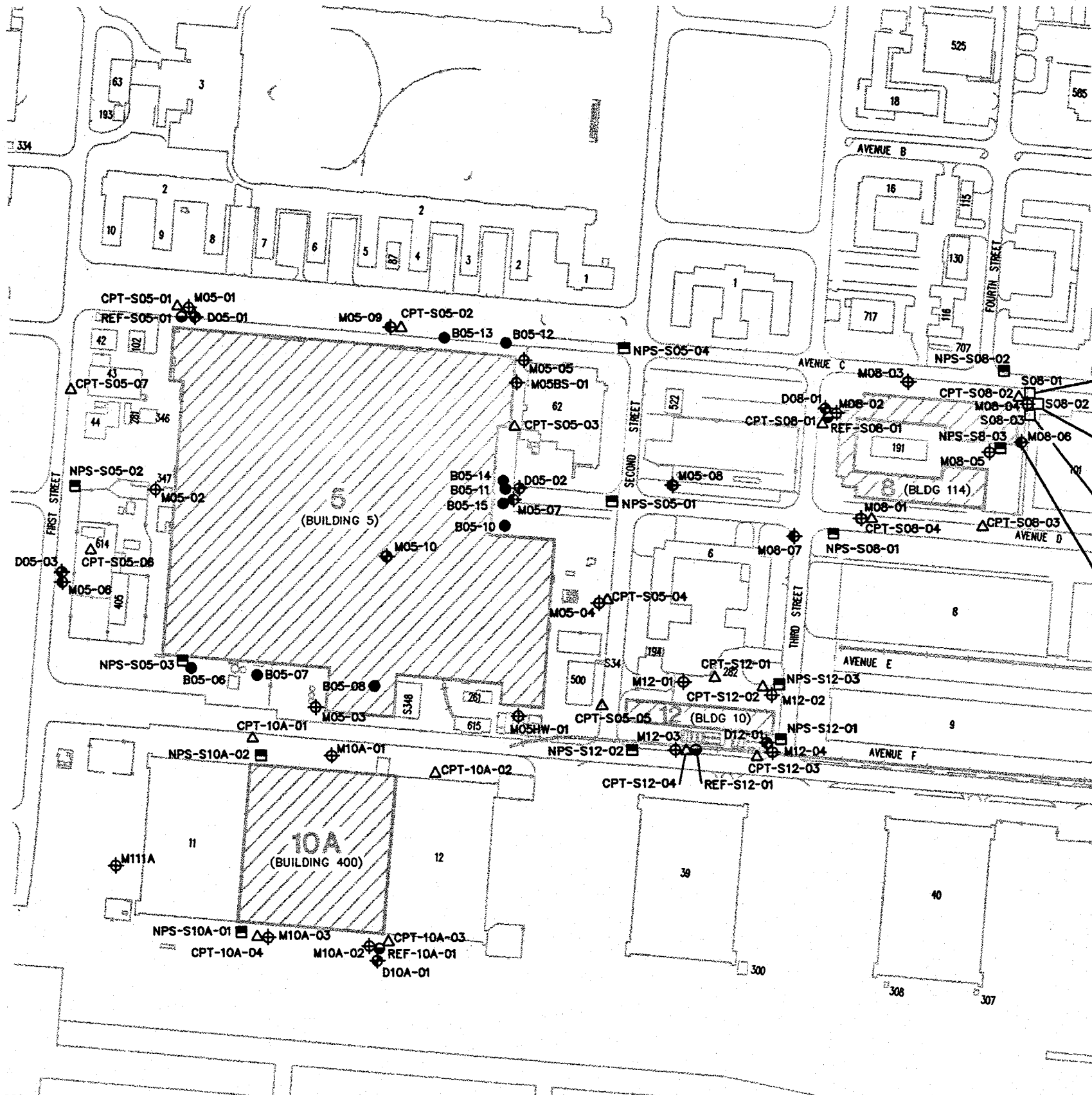


FIGURE 4-4
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5 AND 8
1994 ANALYTICAL RESULTS FOR
VOLATILE AND SEMIVOLATILE ORGANIC
COMPOUNDS IN SOIL (µg/kg)

FILE NAME: E:\ALAMEDA\WTSMAP.DWG
DN
DATE: 01/28/95



	ANALYTE	DEPTH 0.0'
PCB/PEST	AROCOR-1254	260 J
PCB/PEST	AROCOR-1260	550 J

	ANALYTE	DEPTH 0.0'
PCB/PEST	AROCOR-1254	130 J
PCB/PEST	AROCOR-1260	230 J

	ANALYTE	DEPTH 0.0'
PCB/PEST	AROCOR-1254	180
PCB/PEST	AROCOR-1260	380

	ANALYTE	DEPTH 2.5'	DEPTH 5.0'
PCB/PEST	4,4'-DDT	7 J	-
PCB/PEST	GAMMA-CHLORDANE	-	2.2 J

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
PCB COMPOUNDS AND PESTICIDES
WERE ANALYZED AT SITE 8 ONLY

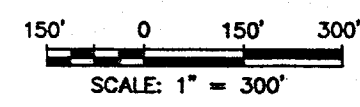


FIGURE 4-5
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 8
1994 ANALYTICAL RESULTS FOR
PCB COMPOUNDS AND PESTICIDES
IN SOIL ($\mu\text{g}/\text{kg}$)

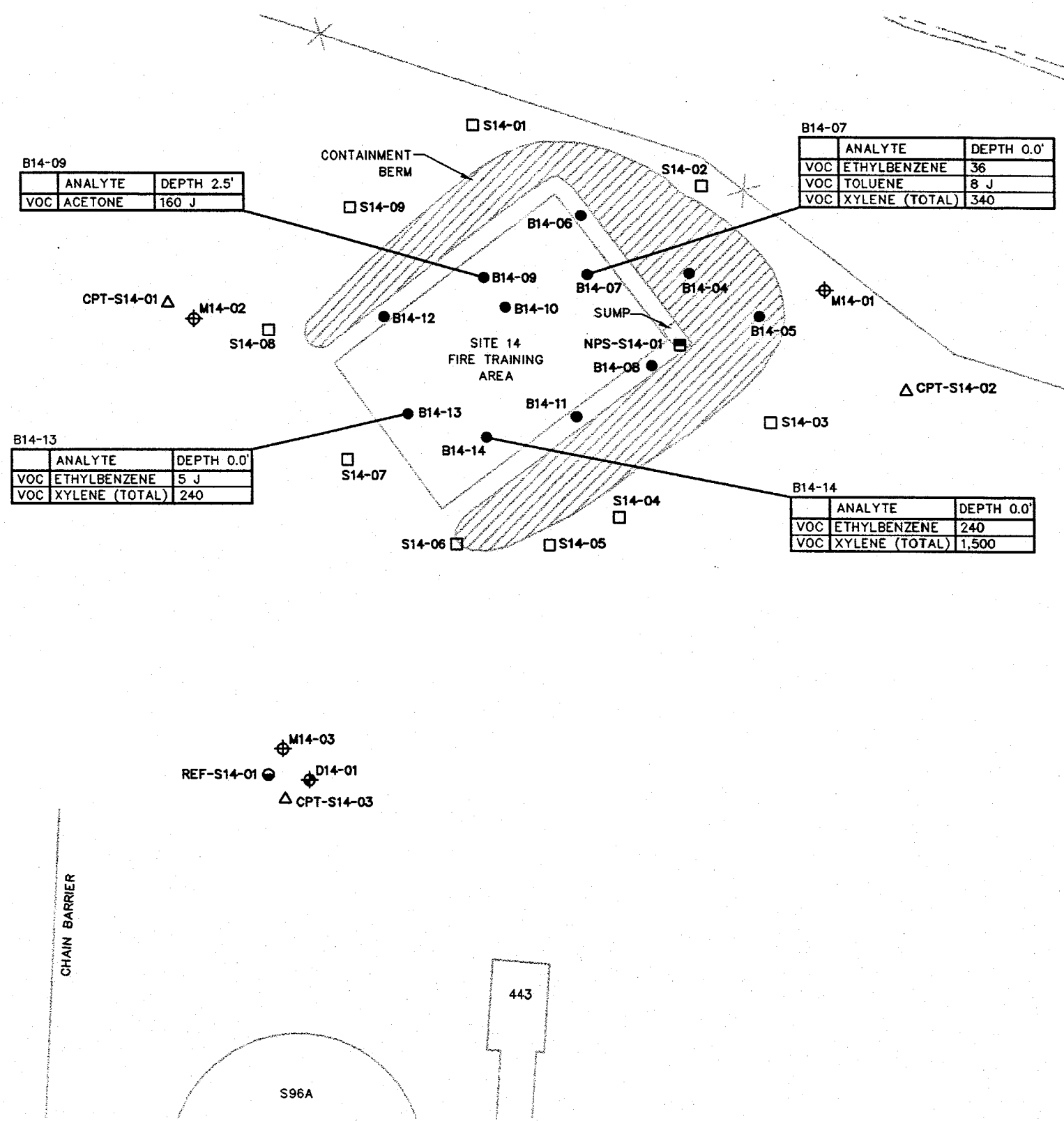


FIGURE 4-6
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN SOIL ($\mu\text{g}/\text{kg}$)

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/28/94
DN



FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/26/95
DN

LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
* UNKNOWN HYDROCARBONS

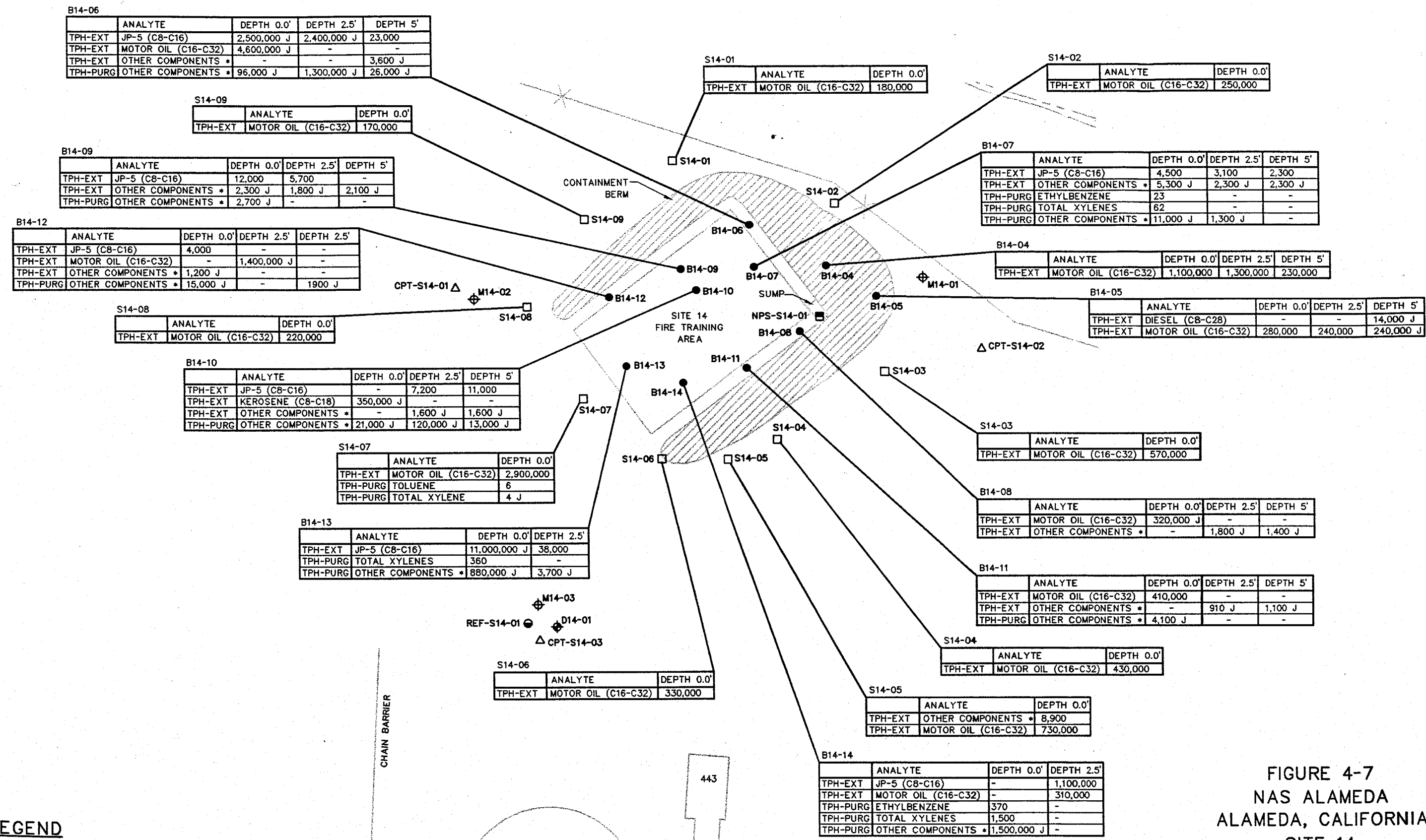
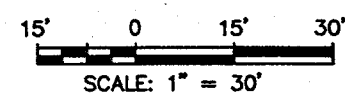


FIGURE 4-7
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14

1994 ANALYTICAL RESULTS FOR
TOTAL PETROLEUM HYDROCARBONS
EXTRACTABLE AND PURGEABLE
IN SOIL (µg/kg)

FILE NAME: E:\ALAMEDA\HITSMAP.DWG
DN
DATE: 01/26/95

LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

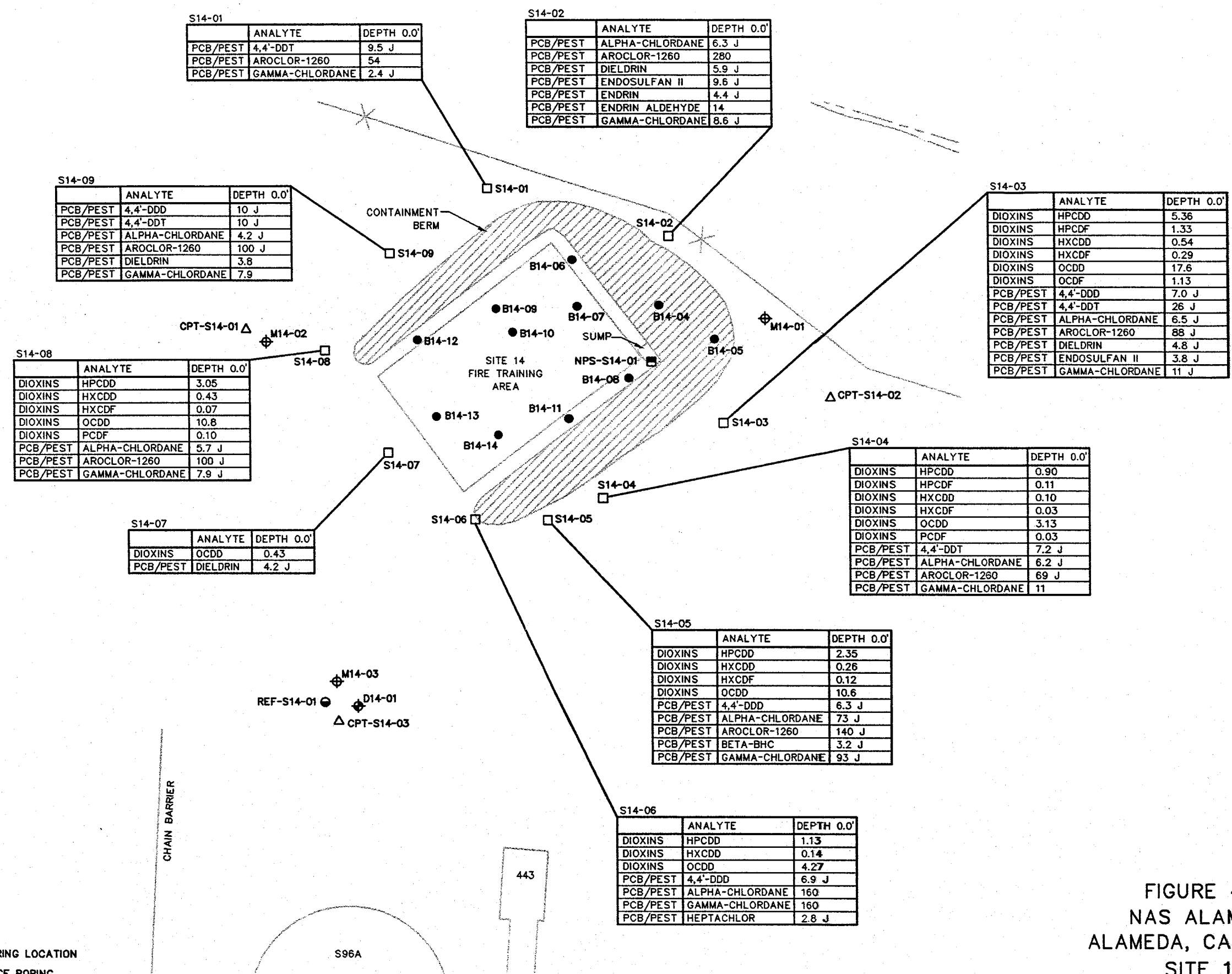


FIGURE 4-8
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
PCB COMPOUNDS, PESTICIDES, AND
DIOXINS IN SOIL (μg/kg)



FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DN
DATE: 01/25/94

LEGEND

PLATING SHOP

SITE LOCATION

SHALLOW MONITORING WELL LOCATION
EXISTING BEFORE CTO 260

SHALLOW MONITORING WELL LOCATION
INSTALLED DURING CTO 260

DEEP MONITORING WELL LOCATION
INSTALLED DURING CTO 260

WATER LEVEL CONTOUR
CONTOUR INTERVAL = 0.4 FEET

NOTE:

SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD
AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER
WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND
SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER
SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 98 FEET
BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED
20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

100' 0 100' 200'
SCALE: 1" = 200'

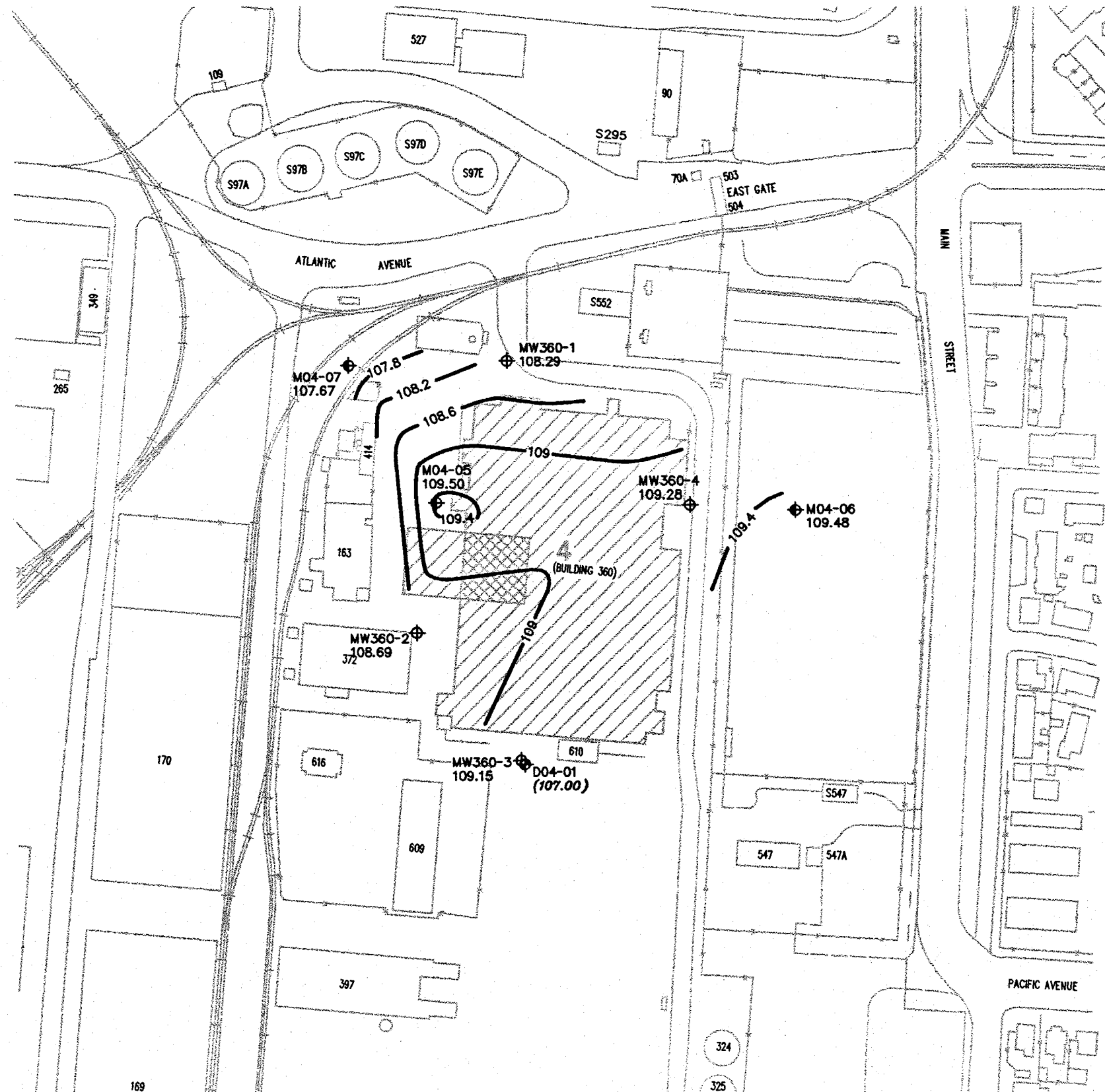


FIGURE 4-9
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
GROUNDWATER CONTOURS
SHALLOW ZONE

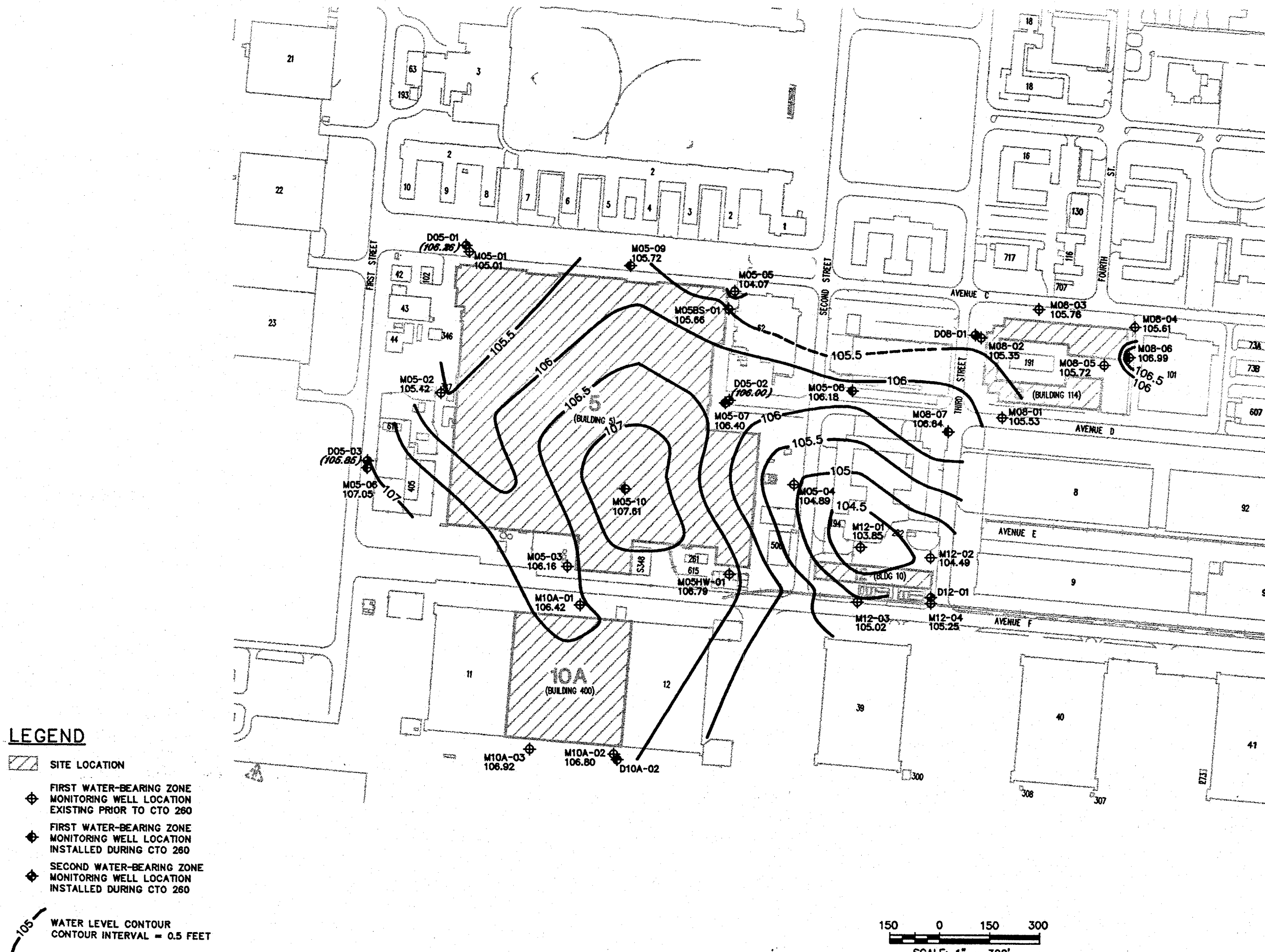
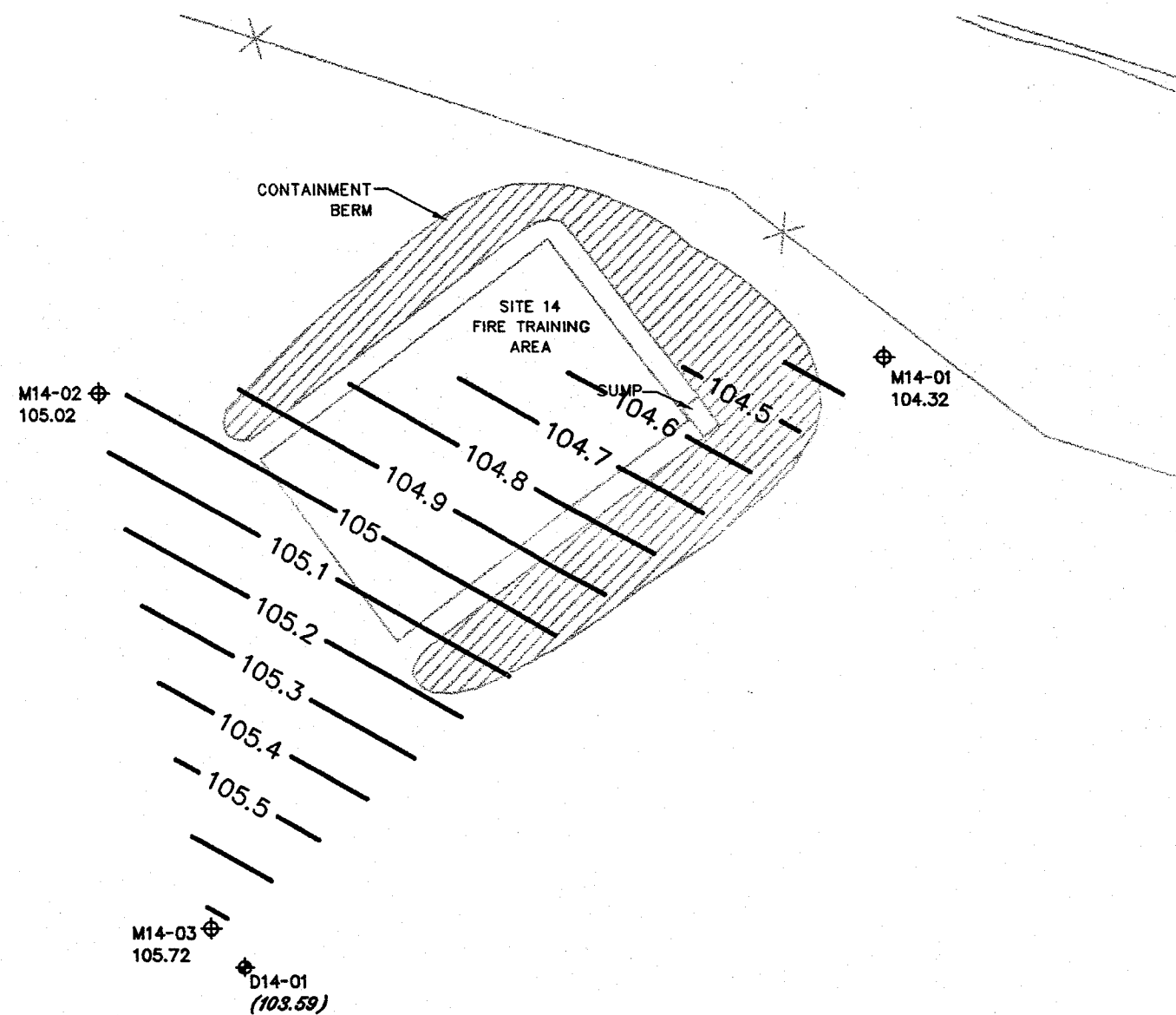


FIGURE 4-10
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
GROUNDWATER CONTOURS
FIRST WATER-BEARING ZONE



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260

WATER LEVEL CONTOUR
CONTOUR INTERVAL = 0.1 FEET






15' 0 15' 30'
SCALE: 1" = 30'

FIGURE 4-11
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
GROUNDWATER CONTOURS
FIRST WATER-BEARING ZONE



FILE NAME: R:\CAD\044\0260\WELL\WELL 260.DWG
DATE: 01/77/96

LEGEND

-  SITE LOCATION
-  FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
-  FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  WATER LEVEL CONTOUR
CONTOUR INTERVAL = 0.1 FEET

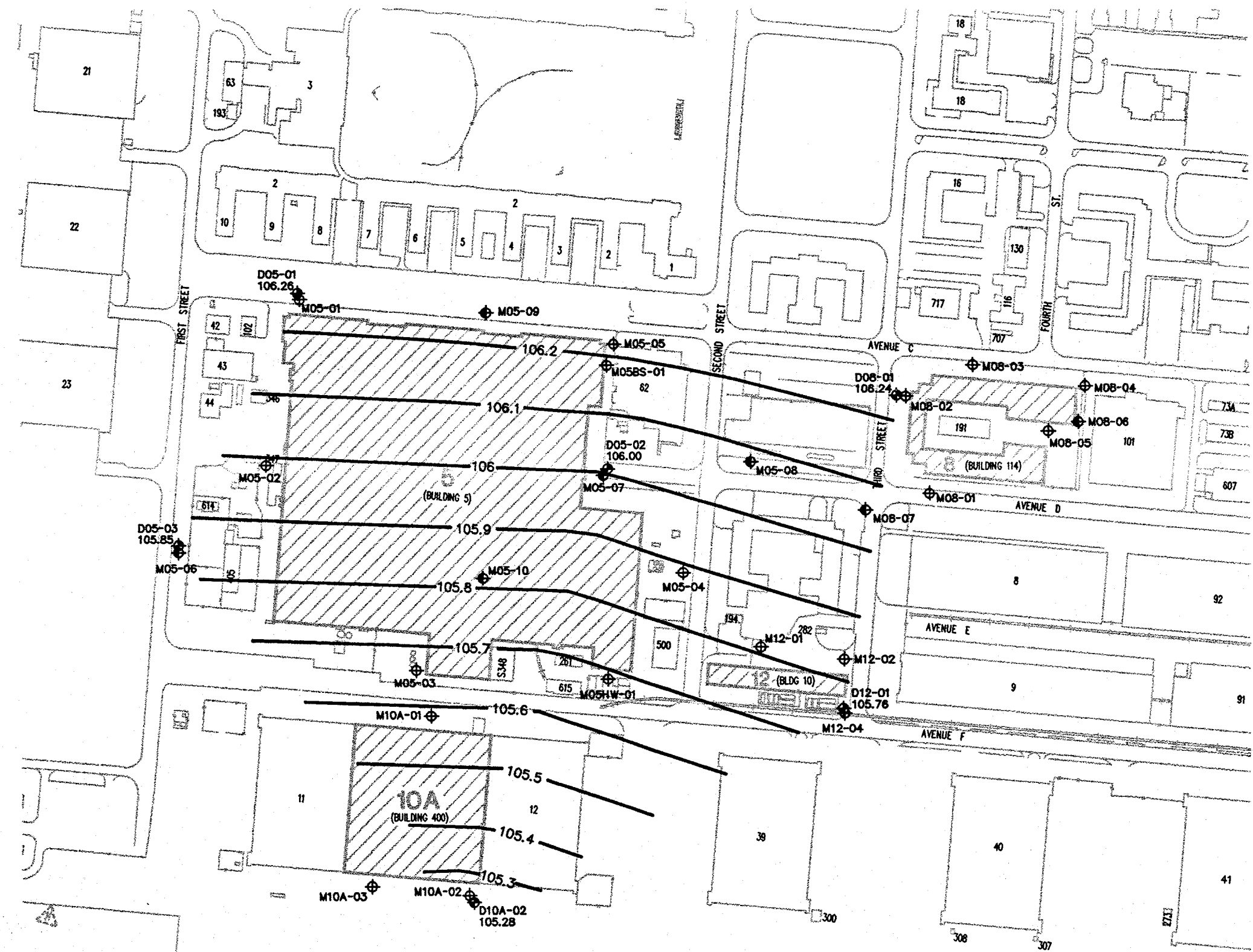


FIGURE 4-12
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
GROUNDWATER CONTOURS
SECOND WATER-BEARING ZONE



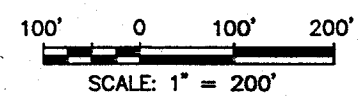
FILE NAME: E:\ALAMEDA\HITSMAP.DWG
DN
DATE: 01/25/95

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:

SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.



MW360-01		
	ANALYTE	
VOC	1,1-DICHLOROETHANE	4 J
VOC	1,2-DICHLOROETHENE (TOTAL)	43
VOC	TRICHLOROETHENE	3,400

M04-07		
	ANALYTE	
VOC	1,2-DICHLOROETHENE (TOTAL)	1 J

M04-05		
	ANALYTE	
VOC	1,1,1-TRICHLOROETHANE	2
VOC	1,1-DICHLOROETHANE	3
VOC	1,1-DICHLOROETHENE	0.4 J
VOC	1,2-DICHLOROETHENE (TOTAL)	0.5 J
VOC	TRICHLOROETHENE	6
VOC	XYLENE (TOTAL)	0.2 J

MW360-02		
	ANALYTE	
VOC	1,1,1-TRICHLOROETHANE	100
VOC	1,1-DICHLOROETHANE	42 J
VOC	1,1-DICHLOROETHENE	360
VOC	TRICHLOROETHENE	100

M04-06		
	ANALYTE	
VOC	1,1-DICHLOROETHANE	0.6 J
VOC	1,1-DICHLOROETHENE	0.1 J
VOC	XYLENE (TOTAL)	2 J

MW360-04		
	ANALYTE	
VOC	1,2-DICHLOROETHENE (TOTAL)	1,300
VOC	TRICHLOROETHENE	5,200
VOC	VINYL CHLORIDE	310

FIGURE 4-13
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SHALLOW ZONE



MW360-01		
	ANALYTE	
SVOC	1,2-DICHLOROBENZENE	34
SVOC	1,4-DICHLOROBENZENE	11

MW360-02		
	ANALYTE	
SVOC	1,2-DICHLOROBENZENE	3 J

MW360-03		
	ANALYTE	
SVOC	BUTYLBENZYLPHTHALATE	10 J
SVOC	CARBAZOLE	10 J

MW360-04		
	ANALYTE	
SVOC	1,2-DICHLOROBENZENE	46
SVOC	1,4-DICHLOROBENZENE	11

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

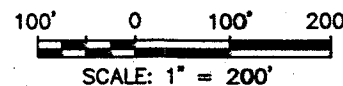


FIGURE 4-14
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
SEMIVOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SHALLOW ZONE

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DATE: 01/25/94
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	ANALYTE	
MW360-01		
METALS	ANTIMONY	3.8 J
METALS	BARIUM	43.1 J
METALS	COBALT	19.7 J
METALS	COPPER	9.0
METALS	NICKEL	1,340
METALS	VANADIUM	7.2 J

	ANALYTE	
M04-07		
METALS	ANTIMONY	3.2 J
METALS	BARIUM	10.0 J
METALS	COPPER	2.4 J
METALS	MOLYBDENUM	26.3
METALS	NICKEL	4.6 J
METALS	VANADIUM	12.8 J

	ANALYTE	
M04-05		
METALS	ANTIMONY	8.4
METALS	BARIUM	233
METALS	CHROMIUM	789
METALS	COPPER	1.7 J
METALS	MOLYBDENUM	114
METALS	NICKEL	15.8
METALS	SELENIUM	3.4 J
METALS	VANADIUM	4.7 J
CYANIDE	CYANIDE	11.5

	ANALYTE	
MW360-02		
METALS	ANTIMONY	2.5 J
METALS	BARIUM	173 J
METALS	COBALT	6.9 J
METALS	COPPER	7.1
METALS	MOLYBDENUM	8.7 J
METALS	NICKEL	9.7
METALS	VANADIUM	4.5 J

	ANALYTE	
MW360-04		
METALS	ANTIMONY	3.4 J
METALS	BARIUM	35.2 J
METALS	COPPER	2.4 J
METALS	MOLYBDENUM	96.8
METALS	NICKEL	10.2
METALS	VANADIUM	5.8 J

	ANALYTE	
M04-06		
METALS	ARSENIC	3.6 J
METALS	BARIUM	18.8 J
METALS	COPPER	4.1 J
METALS	MOLYBDENUM	5.0 J
METALS	NICKEL	5.8 J
METALS	VANADIUM	6.2 J

	ANALYTE	
MW360-03		
METALS	ANTIMONY	3.4 J
METALS	BARIUM	184 J
METALS	COBALT	7.9 J
METALS	COPPER	8.2
METALS	MOLYBDENUM	12.5
METALS	NICKEL	25.1
METALS	VANADIUM	12.1 J

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 88 TO 98 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

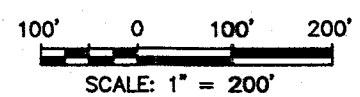


FIGURE 4-15
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
TOTAL METALS AND CYANIDE
IN GROUNDWATER (µg/L)
SHALLOW ZONE

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DN
DATE: 01/25/95

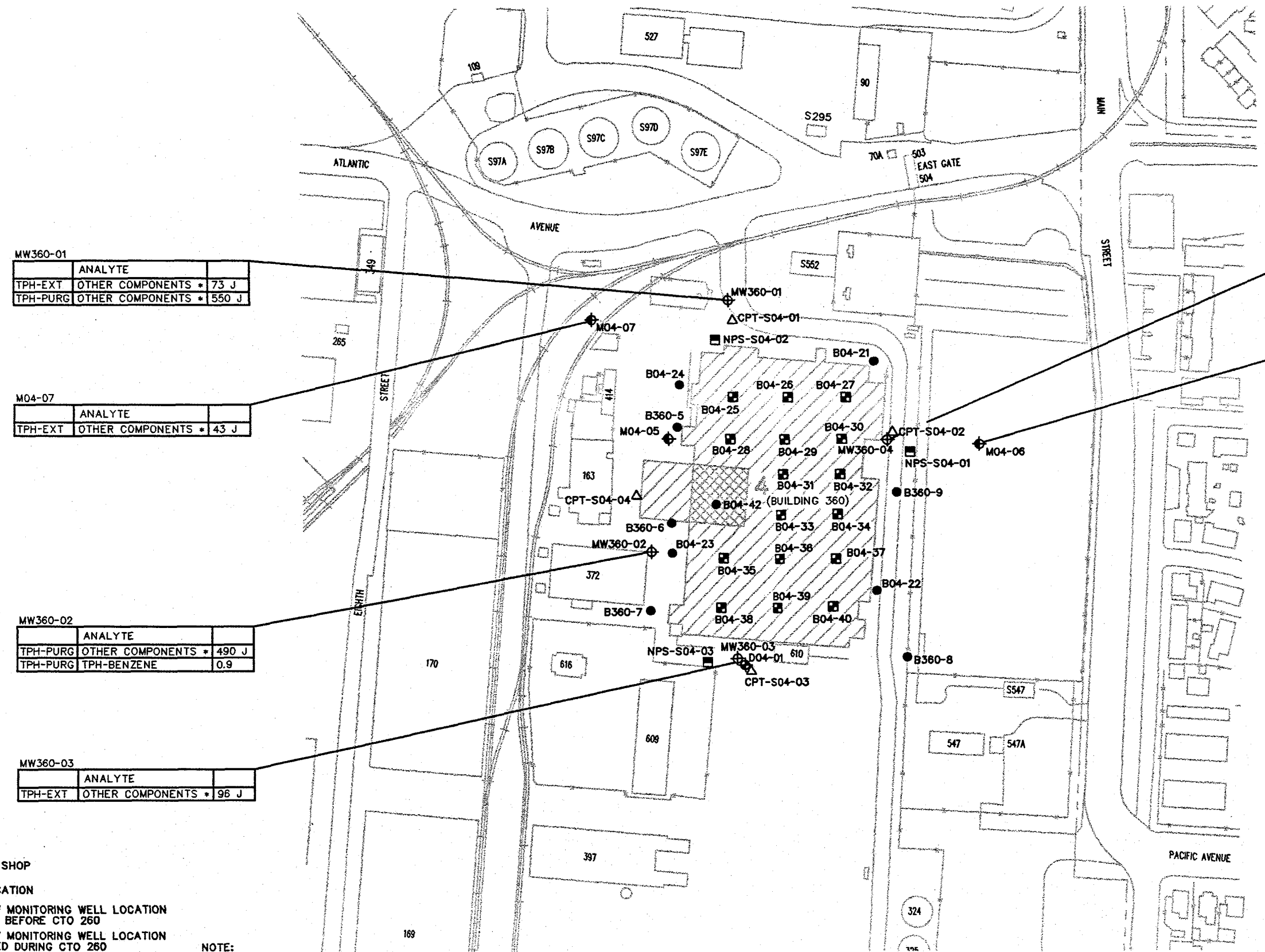
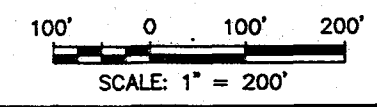


FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DN
DATE: 01/25/95

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.
* UNKNOWN HYDROCARBONS



MW360-01	ANALYTE	
TPH-EXT	OTHER COMPONENTS *	73 J
TPH-PURG	OTHER COMPONENTS *	550 J

M04-07	ANALYTE	
TPH-EXT	OTHER COMPONENTS *	43 J

MW360-02	ANALYTE	
TPH-PURG	OTHER COMPONENTS *	490 J
TPH-PURG	TPH-BENZENE	0.9

MW360-03	ANALYTE	
TPH-EXT	OTHER COMPONENTS *	96 J







MW360-04	ANALYTE	
TPH-EXT	OTHER COMPONENTS *	120 J
TPH-PURG	OTHER COMPONENTS *	1,000 J
TPH-PURG	TPH-TOTAL XYLENES	2

M04-06	ANALYTE	
TPH-PURG	TPH-TOTAL XYLENES	2

FIGURE 4-16
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
TOTAL PETROLEUM HYDROCARBONS
EXTRACTABLE AND PURGEABLE
IN GROUNDWATER ($\mu\text{g/L}$)
SHALLOW ZONE



LEGEND

-  PLATING SHOP
-  SITE LOCATION
-  SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
-  SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  TOTAL DISSOLVED SOLIDS ISOCONTOUR
CONTOUR INTERVAL = 200 mg/L

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD
AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER
WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND
SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER
SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET
BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED
20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

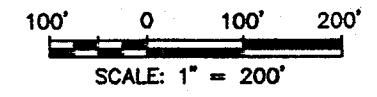


FIGURE 4-17
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4 - TOTAL
DISSOLVED SOLIDS (mg/L)
CONTOURS IN GROUNDWATER
SHALLOW ZONE



CPT-S04-01		
	ANALYTE	
VOC	1,1-DICHLOROETHENE	3 J
VOC	1,2-DICHLOROETHENE (TOTAL)	26
VOC	TRICHLOROETHENE	1,300

CPT-S04-02		
	ANALYTE	
VOC	1,1-DICHLOROETHANE	4 J
VOC	1,1-DICHLOROETHENE	2 J
VOC	1,2-DICHLOROETHENE (TOTAL)	170
VOC	TRICHLOROETHENE	230
VOC	VINYL CHLORIDE	34

D04-01		
	ANALYTE	
VOC	CARBON DISULFIDE	3

CPT-S04-03		
	ANALYTE	
VOC	XYLENE (TOTAL)	0.2 J

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

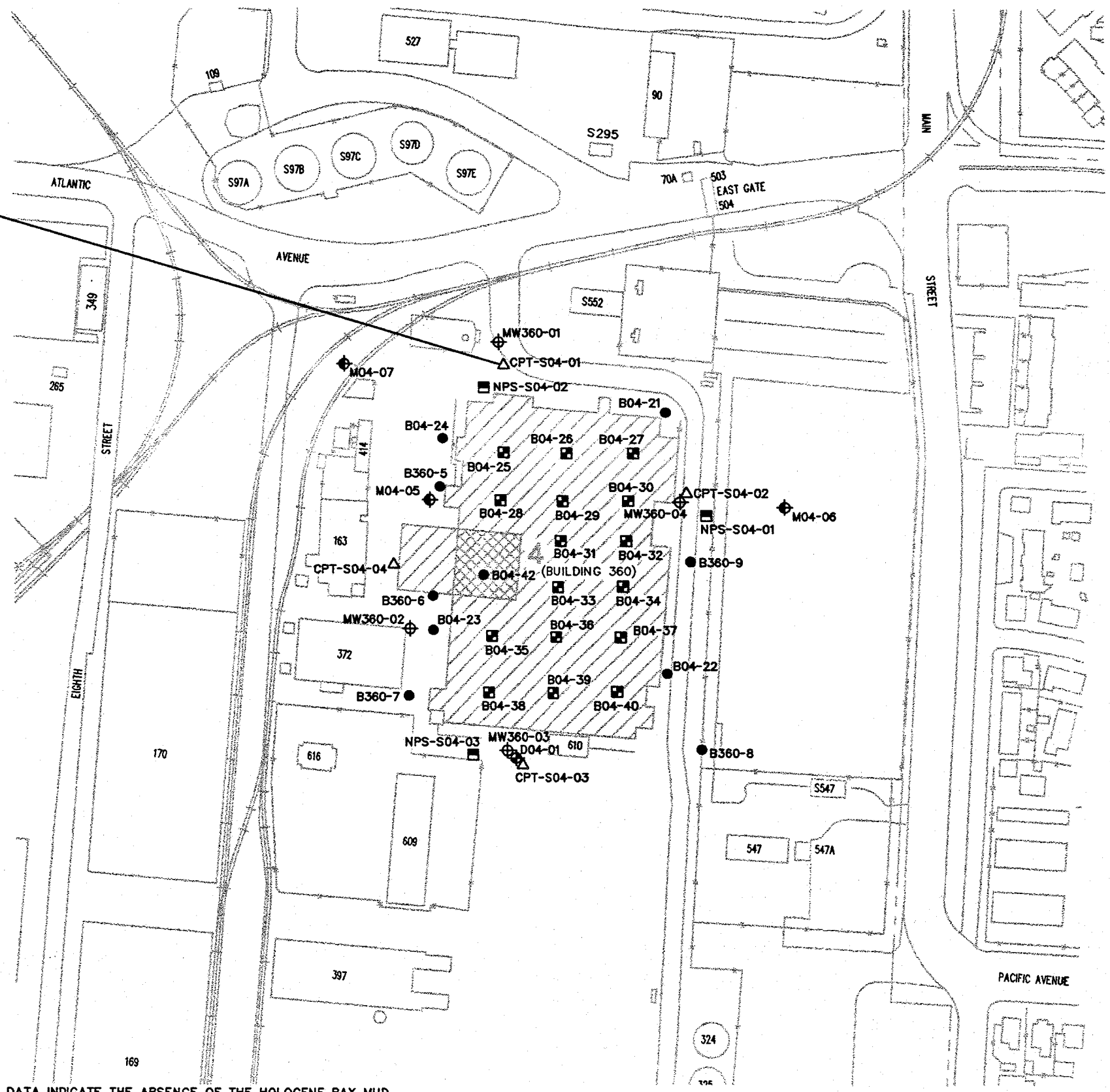
NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

100' 0 100' 200'
SCALE: 1" = 200'

FIGURE 4-18
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
DEEP ZONE



CPT-S04-01		
	ANALYTE	
SVOC	1,2-DICHLOROBENZENE	10 J
SVOC	1,4-DICHLOROBENZENE	3 J



LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 88 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

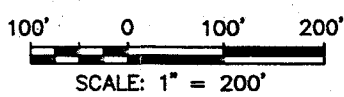
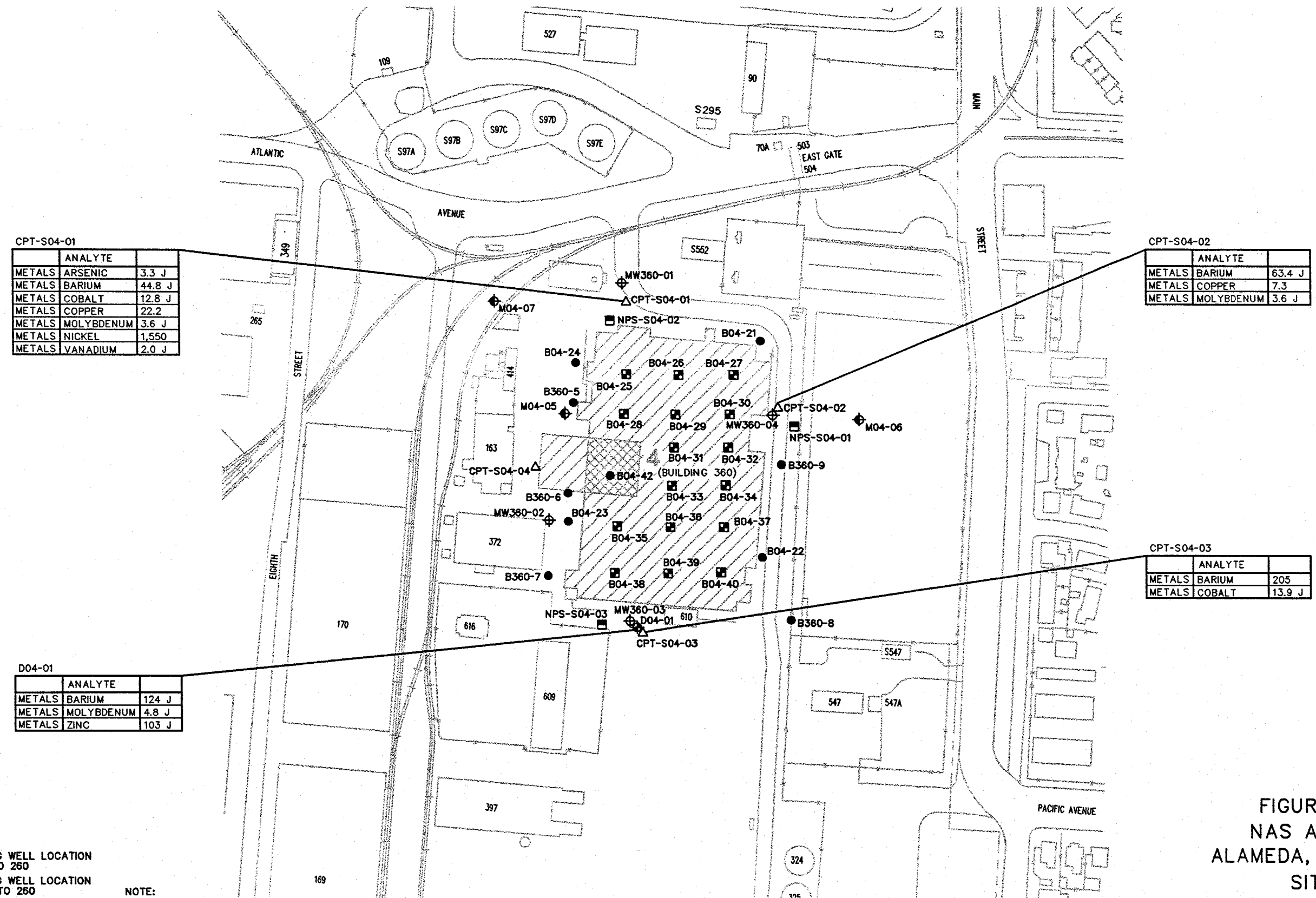


FIGURE 4-19
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
SEMIVOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
DEEP ZONE



NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 98 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

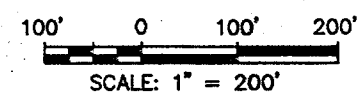


FIGURE 4-20
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
TOTAL METALS AND CYANIDE
IN GROUNDWATER ($\mu\text{g/L}$)
DEEP ZONE

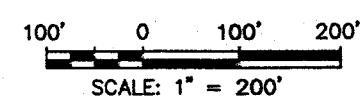


FILE NAME: E:\ALAMEDA\HITSMAP.DWG
DN
DATE: 01/25/95

LEGEND

- PLATING SHOP
- SITE LOCATION
- SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
- SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
- DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- CPT/HYDROPUNCH LOCATION
- SHALLOW SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.
* UNKNOWN HYDROCARBONS

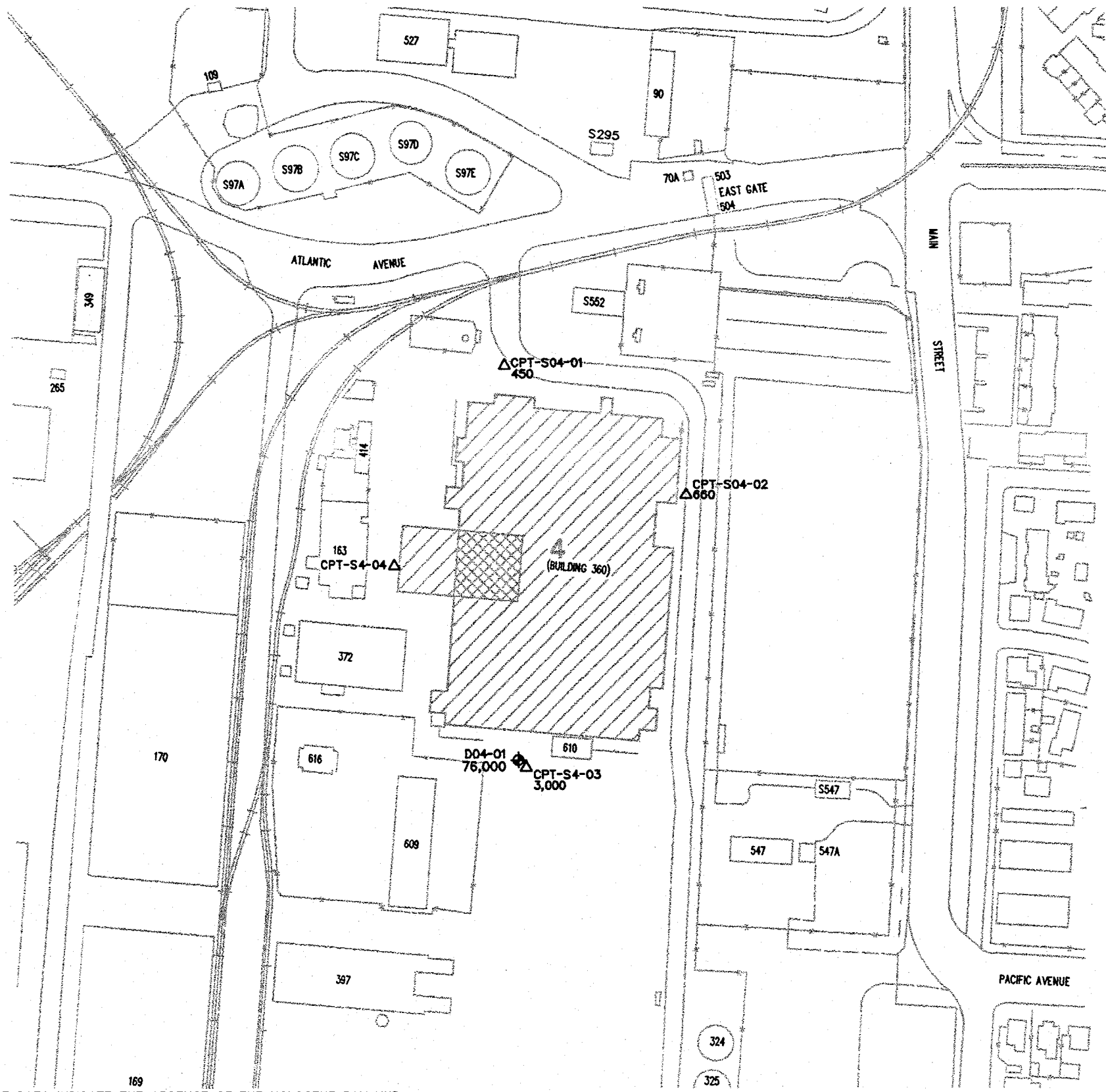


CPT-S04-01		ANALYTE	
TPH-EXT	OTHER COMPONENTS *	480 J	
TPH-PURG	OTHER COMPONENTS *	460 J	








D04-01		ANALYTE	
TPH-EXT	OTHER COMPONENTS *	370 J	

CPT-S04-02		ANALYTE	
TPH-EXT	OTHER COMPONENTS *	560 J	
TPH-PURG	OTHER COMPONENTS *	110 J	

FIGURE 4-21
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
TOTAL PETROLEUM HYDROCARBONS
EXTRACTABLE AND PURGEABLE
IN GROUNDWATER ($\mu\text{g/L}$)
DEEP ZONE



LEGEND

-  PLATING SHOP
-  SITE LOCATION
-  SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
-  SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
-  CPT/HYDROPUNCH LOCATION
-  3,000 TDS CONCENTRATION (mg/L)

NOTE:
SUBSURFACE DATA INDICATE THE ABSENCE OF THE HOLOCENE BAY MUD AQUITARD IN THE VICINITY OF SITE 4. FOR THIS REASON SHALLOWER WELLS AT SITE 4 (TYPICALLY SCREENED 5 TO 15 FEET BELOW GROUND SURFACE) ARE REFERRED TO AS "SHALLOW ZONE" WELLS. DEEPER SAMPLING LOCATIONS SUCH AS WELL D04-01 (SCREENED 86 TO 96 FEET BELOW GROUND SURFACE) AND CPT/HYDROPUNCH LOCATIONS (SAMPLED 20 FEET BELOW GROUND SURFACE) ARE CONSIDERED "DEEP ZONE" SAMPLES.

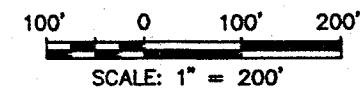


FIGURE 4-22
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
TOTAL DISSOLVED SOLIDS (mg/L)
IN GROUNDWATER
DEEP ZONE

FILE NAME: E:\ALAMEDA\HITS\MAP.DWG
DN
DATE: 01/28/93



M05BS-01		
ANALYTE		
VOC	1,1-DICHLOROETHANE	8
VOC	1,2-DICHLOROETHENE (TOTAL)	9
VOC	BENZENE	2
VOC	TOLUENE	0.3 J
VOC	TRICHLOROETHENE	0.6 J
VOC	VINYL CHLORIDE	65

M05-09		
ANALYTE		
VOC	1,1-DICHLOROETHANE	1 J
VOC	1,1-DICHLOROETHENE	0.2 J

M05-01		
ANALYTE		
VOC	TOLUENE	0.2 J

M05-02		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	4
VOC	1,1-DICHLOROETHANE	2 J
VOC	1,1-DICHLOROETHENE	2
VOC	1,2-DICHLOROETHENE (TOTAL)	12
VOC	BENZENE	2
VOC	TETRACHLOROETHENE	2
VOC	TOLUENE	2 J
VOC	TRICHLOROETHENE	5
VOC	VINYL CHLORIDE	42 J

M05-06		
ANALYTE		
VOC	TOLUENE	0.6 J

M05-10		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	150
VOC	1,1-DICHLOROETHANE	19
VOC	1,1-DICHLOROETHENE	5 J
VOC	1,2-DICHLOROETHENE (TOTAL)	1 J

M05-03		
ANALYTE		
VOC	1,1-DICHLOROETHANE	17 J
VOC	1,1-DICHLOROETHENE	8 J
VOC	1,2-DICHLOROETHENE (TOTAL)	56
VOC	CHLOROETHANE	51
VOC	ETHYLBENZENE	32
VOC	TOLUENE	33
VOC	TRICHLOROETHENE	270
VOC	VINYL CHLORIDE	43
VOC	XYLENE (TOTAL)	320

M05-05		
ANALYTE		
VOC	1,1-DICHLOROETHANE	5
VOC	1,1-DICHLOROETHENE	0.6 J
VOC	1,2-DICHLOROETHENE (TOTAL)	64
VOC	BENZENE	0.5 J
VOC	TRICHLOROETHENE	2 J
VOC	VINYL CHLORIDE	63

M05-07		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	9000
VOC	1,1-DICHLOROETHANE	41000
VOC	1,1-DICHLOROETHENE	3800
VOC	1,2-DICHLOROETHENE (TOTAL)	1300 J
VOC	CHLOROETHANE	1700 J
VOC	TRICHLOROETHENE	2400 J

M05-08		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	38
VOC	1,1-DICHLOROETHANE	75
VOC	1,1-DICHLOROETHENE	11
VOC	1,2-DICHLOROETHENE (TOTAL)	3 J
VOC	TETRACHLOROETHENE	1 J
VOC	TOLUENE	0.8 J
VOC	TRICHLOROETHENE	20

M05-04		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	34
VOC	1,1-DICHLOROETHANE	370
VOC	1,1-DICHLOROETHENE	120
VOC	1,1-DICHLOROETHANE	2
VOC	1,2-DICHLOROETHENE (TOTAL)	440
VOC	BENZENE	1
VOC	CHLOROETHANE	47
VOC	CHLOROFORM	3
VOC	TETRACHLOROETHENE	11
VOC	TRICHLOROETHENE	480
VOC	VINYL CHLORIDE	140

M05HW-01		
ANALYTE		
VOC	1,1-DICHLOROETHANE	19
VOC	1,1-DICHLOROETHENE	0.8 J
VOC	1,2-DICHLOROETHENE (TOTAL)	14
VOC	BENZENE	0.7
VOC	CHLOROBENZENE	3
VOC	TETRACHLOROETHENE	4
VOC	TOLUENE	0.5 J
VOC	TRICHLOROETHENE	12
VOC	VINYL CHLORIDE	10
VOC	XYLENE (TOTAL)	0.2 J

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

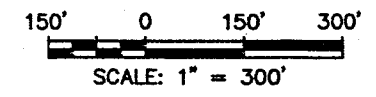
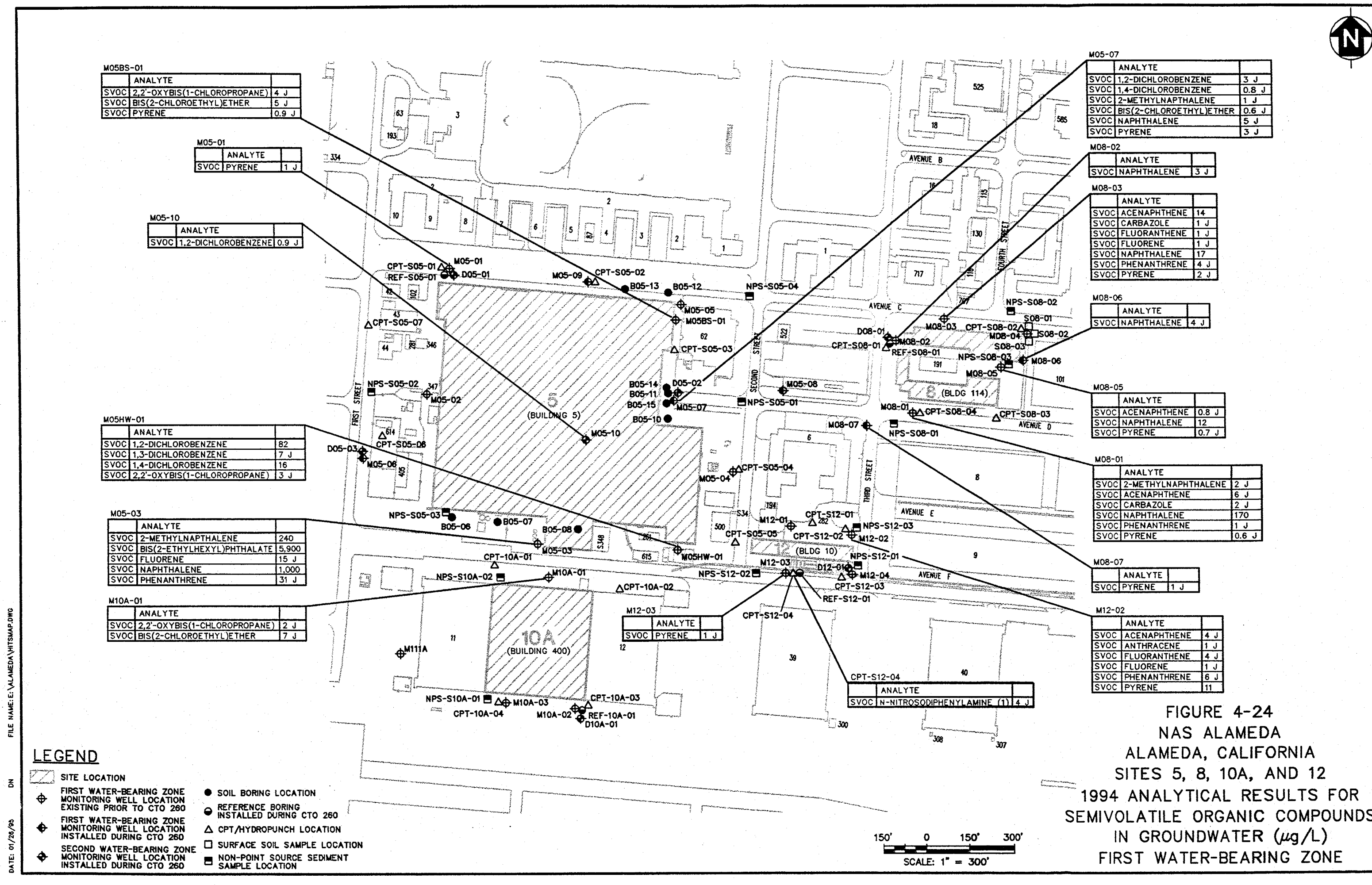


FIGURE 4-23
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 5
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE





M05-09		
	ANALYTE	
METALS	ARSENIC	6.1 J
METALS	BARIUM	68.4 J
METALS	LEAD	0.98 J
METALS	VANADIUM	2.7 J

M05-01		
	ANALYTE	
METALS	ANTIMONY	3.9 J
METALS	BARIUM	127 J
METALS	COPPER	2.6 J
METALS	VANADIUM	3.1 J

M05-05		
	ANALYTE	
METALS	ANTIMONY	3.7 J
METALS	ARSENIC	10.6
METALS	BARIUM	213
METALS	MOLYBDENUM	3.5 J
METALS	NICKEL	7.6 J
METALS	VANADIUM	3.2 J

M05-02		
	ANALYTE	
METALS	ANTIMONY	3.2 J
METALS	BARIUM	274
METALS	COPPER	3.5 J
METALS	MOLYBDENUM	3.2 J
METALS	NICKEL	6.0 J
METALS	VANADIUM	5.6 J

M05BS-01		
	ANALYTE	
METALS	ANTIMONY	4.0 J
METALS	ARSENIC	11.5
METALS	BARIUM	549
METALS	CADMIUM	0.74 J
METALS	MOLYBDENUM	7.7 J
METALS	NICKEL	63.8
METALS	VANADIUM	2.7 J

M05-06		
	ANALYTE	
METALS	ANTIMONY	2.0 J
METALS	ARSENIC	4.9 J
METALS	BARIUM	31.8 J
METALS	THALLIUM	20.0 J
METALS	VANADIUM	4.7 J

M05-08		
	ANALYTE	
METALS	ARSENIC	43.6
METALS	BARIUM	80.3 J
METALS	LEAD	1.3 J
METALS	MOLYBDENUM	4.5 J
METALS	NICKEL	4.0 J
METALS	SELENIUM	14.1

M05-10		
	ANALYTE	
METALS	ANTIMONY	2.8 J
METALS	ARSENIC	13.1
METALS	BARIUM	8.9 J
METALS	CHROMIUM	15.1
METALS	COPPER	6.4
METALS	VANADIUM	3.2 J
CYANIDE	CYANIDE	40.2

M05-07		
	ANALYTE	
METALS	ARSENIC	29.8
METALS	BARIUM	165 J
METALS	CADMIUM	0.95 J
METALS	LEAD	1.4 J
METALS	NICKEL	15.4 J
METALS	SELENIUM	16.1
METALS	VANADIUM	2.1 J

M05-03		
	ANALYTE	
METALS	ARSENIC	69.1
METALS	BARIUM	165 J
METALS	CADMIUM	1.5
METALS	LEAD	3.2
METALS	MOLYBDENUM	2.2 J
METALS	NICKEL	161 J
METALS	SELENIUM	24.3
CYANIDE	CYANIDE	13.5

M05HW-01		
	ANALYTE	
METALS	ARSENIC	5.1 J
METALS	BARIUM	90.5 J
METALS	COPPER	1.2 J
METALS	NICKEL	27.5 J
METALS	SELENIUM	11.8
METALS	VANADIUM	3.2 J
CYANIDE	CYANIDE	14.3

M05-04		
	ANALYTE	
METALS	ARSENIC	18.1
METALS	BARIUM	125 J
METALS	LEAD	1.6 J
METALS	MOLYBDENUM	11.9
METALS	NICKEL	9.0 J
METALS	SELENIUM	28.1
METALS	VANADIUM	3.1 J

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

150' 0 150' 300'
SCALE: 1" = 300'

FIGURE 4-25
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 5
1994 ANALYTICAL RESULTS FOR
TOTAL METALS AND CYANIDE
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE

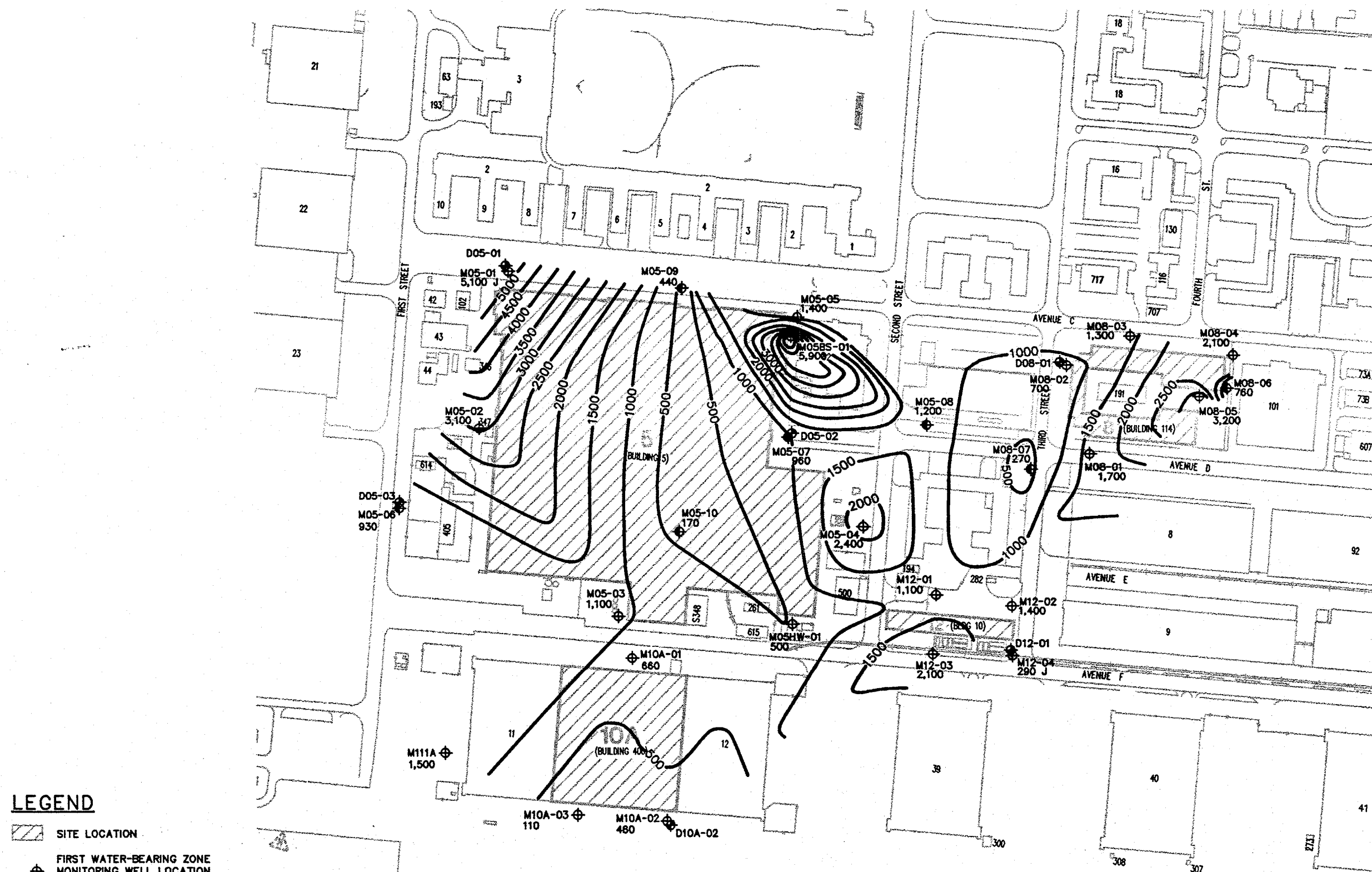


FIGURE 4-26
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
TOTAL DISSOLVED SOLIDS (mg/L)
CONTOURS IN GROUNDWATER
FIRST WATER-BEARING ZONE



CPT-S05-02		
	ANALYTE	
VOC	BENZENE	0.1 J
VOC	CARBON DISULFIDE	0.8 J

CPT-S05-01		
	ANALYTE	
VOC	CARBON DISULFIDE	36

D05-01		
	ANALYTE	
VOC	CARBON DISULFIDE	0.3 J
VOC	CHLOROFORM	0.6 J

CPT-S05-07		
	ANALYTE	
VOC	CARBON DISULFIDE	4

D05-03		
	ANALYTE	
VOC	CARBON DISULFIDE	0.5 J
VOC	CHLOROFORM	0.4 J

CPT-S05-03		
	ANALYTE	
VOC	1,1-DICHLOROETHANE	3
VOC	1,1-DICHLOROETHENE	0.3 J
VOC	1,2-DICHLOROETHENE (TOTAL)	4
VOC	BENZENE	0.3 J
VOC	CARBON DISULFIDE	0.1 J
VOC	TRICHLOROETHENE	2
VOC	VINYL CHLORIDE	1 J

D05-02		
	ANALYTE	
VOC	CARBON DISULFIDE	0.2 J

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DATE: 01/26, 2001

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

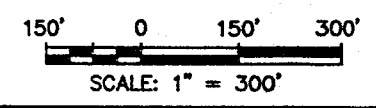


FIGURE 4-27
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 5
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE



CPT-S05-07	
ANALYTE	
SVOC N-NITROSODIPHENYLAMINE (1)	1 J

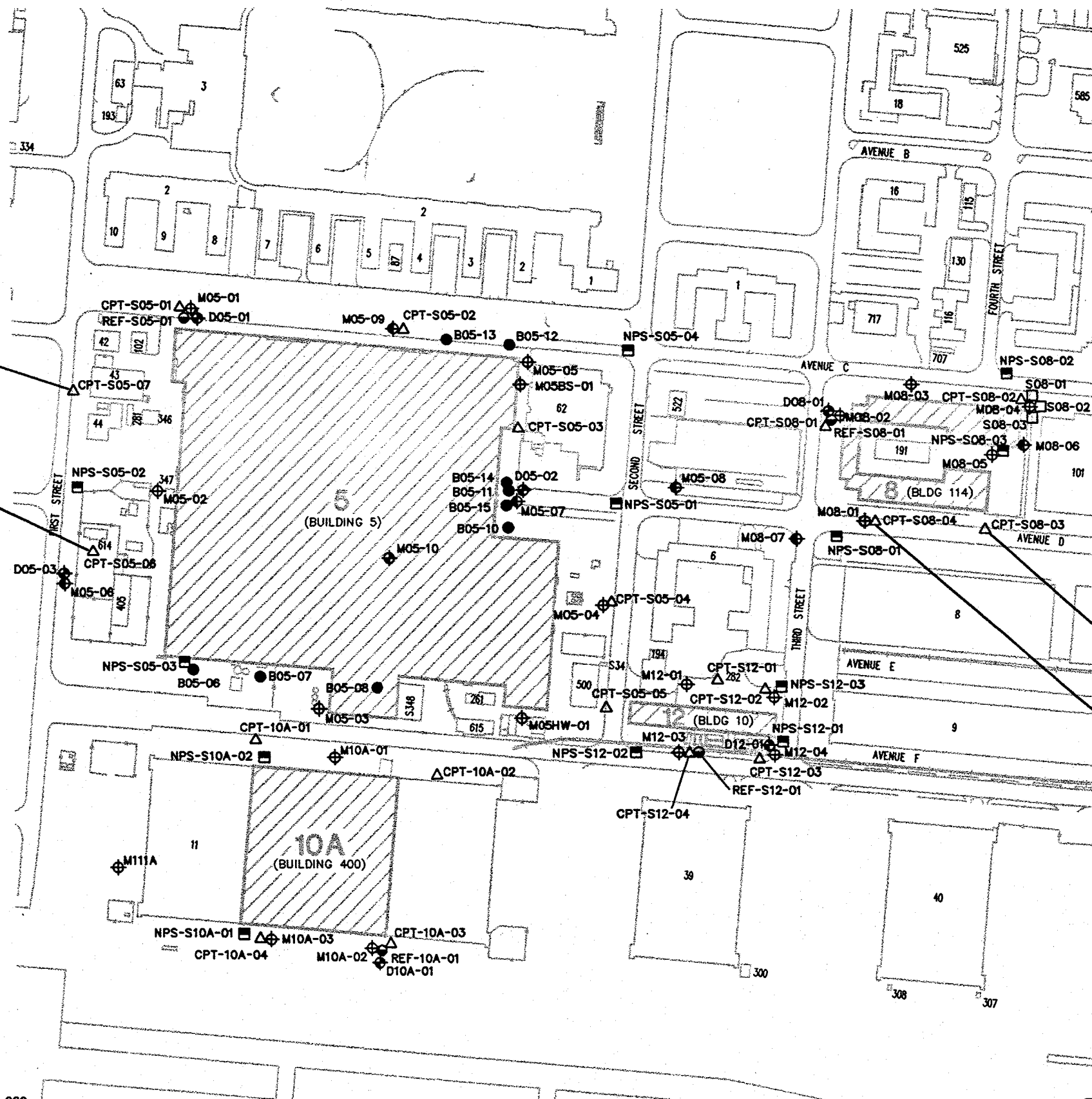
CPT-S05-06	
ANALYTE	
SVOC N-NITROSODIPHENYLAMINE (1)	1 J

CPT-S08-03	
ANALYTE	
SVOC N-NITROSODIPHENYLAMINE (1)	0.7 J

CPT-S08-04	
ANALYTE	
SVOC N-NITROSODIPHENYLAMINE (1)	0.8 J

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION



150' 0 150' 300'
SCALE: 1" = 300'

FIGURE 4-28
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5 AND 8
1994 ANALYTICAL RESULTS FOR
SEMIVOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE



	ANALYTE	
METALS	BARIUM	666
METALS	LEAD	20.2
METALS	MOLYBDENUM	7.4 J
METALS	SILVER	2.7
METALS	VANADIUM	22.2 J

	ANALYTE	
METALS	ARSENIC	14.8 J
METALS	BARIUM	185 J
METALS	LEAD	154 J
METALS	SILVER	3.6
METALS	VANADIUM	29.8 J

	ANALYTE	
METALS	ARSENIC	7.1 J
METALS	BARIUM	121 J
METALS	VANADIUM	15.2 J
METALS	ZINC	87.3

	ANALYTE	
METALS	BARIUM	88.2 J
METALS	CADMIUM	4 J
METALS	COBALT	11.9 J
METALS	COPPER	9 J
METALS	NICKEL	15.4 J
METALS	VANADIUM	3.2 J
METALS	ZINC	303

	ANALYTE	
METALS	ARSENIC	12.3
METALS	BARIUM	119 J
METALS	COBALT	13.8 J
METALS	MOLYBDENUM	3.9 J
METALS	VANADIUM	4.7 J

	ANALYTE	
METALS	BARIUM	69 J
METALS	BERYLLIUM	2.6 J
METALS	CADMIUM	2.1 J
METALS	COBALT	21.6 J
METALS	COPPER	4.9 J
METALS	NICKEL	30.8 J
METALS	VANADIUM	1.6 J
METALS	ZINC	140 J

	ANALYTE	
METALS	ANTIMONY	2.6 J
METALS	ARSENIC	4.2 J
METALS	BARIUM	345
METALS	COPPER	10.5
METALS	LEAD	27.8 J
METALS	MOLYBDENUM	7.0 J
METALS	SILVER	2.6
METALS	VANADIUM	2.9 J

	ANALYTE	
METALS	ARSENIC	9.1
METALS	BARIUM	58.2 J
METALS	CADMIUM	1.7 J
METALS	COPPER	1.4 J
METALS	LEAD	12.8 J
METALS	NICKEL	17 J
METALS	ZINC	82.5 J

	ANALYTE	
METALS	BARIUM	84.0 J
METALS	CHROMIUM	11.3
METALS	COBALT	62.4
METALS	COPPER	38.5
METALS	NICKEL	50.8
METALS	SILVER	6.3

	ANALYTE	
METALS	ARSENIC	14.1 J
METALS	BARIUM	151 J
METALS	CADMIUM	5.3 J
METALS	COBALT	67.5
METALS	MOLYBDENUM	3.4 J
METALS	NICKEL	51.6
METALS	SILVER	5.1

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

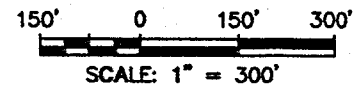


FIGURE 4-29
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 5
1994 ANALYTICAL RESULTS FOR
TOTAL METALS AND CYANIDE
IN GROUNDWATER (µg/L)
SECOND WATER-BEARING ZONE



FILE NAME: R:\CAD\044\0260\VR\W\260.DWG
DATE: 01/27/95

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- (30,000) HYDROPUNCH TDS CONCENTRATION (mg/L) NOT USED FOR CONTOURING
- 105 TOTAL DISSOLVED SOLIDS ISOCONTOUR
CONTOUR INTERVAL = 2,000 mg/L

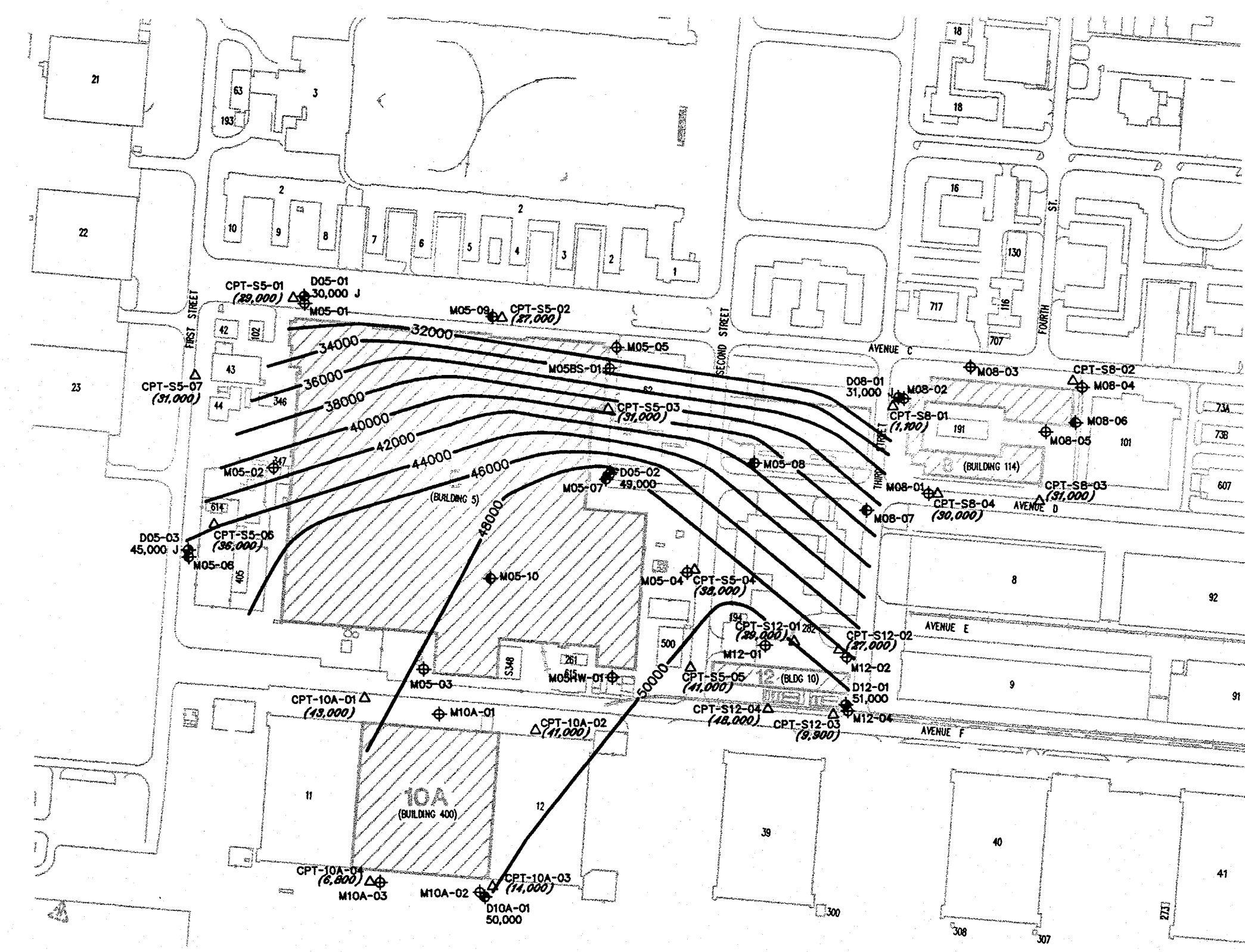


FIGURE 4-30
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
TOTAL DISSOLVED SOLIDS (mg/L)
CONTOURS IN GROUNDWATER
SECOND WATER-BEARING ZONE



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DATE: 01/26/94

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

M10A-01

	ANALYTE	
VOC	1,1-DICHLOROETHANE	5
VOC	1,2-DICHLOROETHENE (TOTAL)	0.4 J
VOC	CHLOROFORM	0.3 J
VOC	TRICHLOROETHENE	1 J

M10A-02

	ANALYTE	
VOC	CHLOROFORM	0.8 J

M10A-03

	ANALYTE	
VOC	BENZENE	0.1 J
VOC	CHLOROFORM	32

M111A

	ANALYTE	
VOC	1,1-DICHLOROETHANE	1 J
VOC	1,1-DICHLOROETHENE	2 J
VOC	BENZENE	0.1 J

M08-02

	ANALYTE	
VOC	BENZENE	3
VOC	ETHYLBENZENE	3
VOC	TOLUENE	0.8 J

M08-03

	ANALYTE	
VOC	BENZENE	0.9
VOC	ETHYLBENZENE	1 J

M08-06

	ANALYTE	
VOC	BENZENE	2
VOC	ETHYLBENZENE	0.9 J
VOC	TOLUENE	0.3 J
VOC	XYLENE (TOTAL)	0.4 J

M08-05

	ANALYTE	
VOC	BENZENE	3
VOC	ETHYLBENZENE	2

M08-01

	ANALYTE	
VOC	1,2-DICHLOROETHENE (TOTAL)	6
VOC	BENZENE	3
VOC	ETHYLBENZENE	1 J

M08-07

	ANALYTE	
VOC	1,1,1-TRICHLOROETHANE	0.8 J
VOC	1,1-DICHLOROETHANE	0.4 J
VOC	1,2-DICHLOROETHENE (TOTAL)	0.4 J
VOC	TRICHLOROETHENE	3

M12-02

	ANALYTE	
VOC	BENZENE	0.2 J
VOC	TOLUENE	0.5 J

M12-01

	ANALYTE	
VOC	TETRACHLOROETHENE	0.8 J

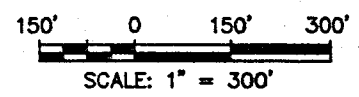


FIGURE 4-31
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 8, 10A, AND 12
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

M12-01

METALS	ANALYTE	
METALS	ANTIMONY	3.9 J
METALS	BARIUM	154 J
METALS	COPPER	3.4 J
METALS	MOLYBDENUM	5.6 J
METALS	NICKEL	10.9
METALS	VANADIUM	5.3 J

M12-03

METALS	ANALYTE	
METALS	BARIUM	225
METALS	COPPER	3.6 J
METALS	NICKEL	5.2 J
METALS	VANADIUM	2.4 J

M10A-01

METALS	ANALYTE	
METALS	ARSENIC	10.4
METALS	BARIUM	18.1 J
METALS	COBALT	6.7 J
METALS	MOLYBDENUM	3.0 J
METALS	NICKEL	118
METALS	SELENIUM	3.9 J
METALS	VANADIUM	6.7 J

M10A-03

METALS	ANALYTE	
METALS	ALUMINUM	176
METALS	ARSENIC	6.2 J
METALS	BARIUM	0.68 J
METALS	VANADIUM	27.8 J

M111A

METALS	ANALYTE	
METALS	ARSENIC	8.7 J
METALS	BARIUM	59.4 J
METALS	MOLYBDENUM	5.6 J
METALS	SELENIUM	7.0
METALS	VANADIUM	3.4 J

M10A-02

METALS	ANALYTE	
METALS	ARSENIC	6.3 J
METALS	BARIUM	5.5 J
METALS	CHROMIUM	4.5 J
METALS	VANADIUM	10.8 J

M12-02

METALS	ANALYTE	
METALS	ANTIMONY	3.7 J
METALS	ARSENIC	5.1 J
METALS	BARIUM	19.9 J
METALS	CHROMIUM	4.4 J
METALS	COPPER	2.3 J
METALS	NICKEL	2.7 J
METALS	VANADIUM	10.3 J

MOB-02

METALS	ANALYTE	
METALS	ARSENIC	9.9 J
METALS	BARIUM	393
METALS	NICKEL	6.0 J
METALS	SELENIUM	13.9
METALS	VANADIUM	9.0 J
METALS	ZINC	3.1 J

MOB-03

METALS	ANALYTE	
METALS	ARSENIC	9.2 J
METALS	BARIUM	213
METALS	SELENIUM	8.1
METALS	VANADIUM	3.8 J
METALS	ZINC	10.0 J

MOB-04

METALS	ANALYTE	
METALS	ARSENIC	13.7
METALS	BARIUM	424
METALS	CADMIUM	0.87 J
METALS	MERCURY	0.11
METALS	NICKEL	3.9 J
METALS	SELENIUM	10.1
METALS	ZINC	7.1 J

MOB-06

METALS	ANALYTE	
METALS	ARSENIC	4.3 J
METALS	BARIUM	110 J
METALS	MERCURY	0.11
METALS	SELENIUM	3.3 J
METALS	VANADIUM	3.2 J

MOB-05

METALS	ANALYTE	
METALS	ARSENIC	10.1
METALS	BARIUM	116 J
METALS	MERCURY	0.10
METALS	MOLYBDENUM	2.3 J
METALS	NICKEL	3.5 J
METALS	SELENIUM	7.5
METALS	VANADIUM	1.5 J

MOB-01

METALS	ANALYTE	
METALS	ARSENIC	10.4
METALS	BARIUM	102 J
METALS	CADMIUM	0.69 J
METALS	MOLYBDENUM	3.2 J
METALS	SELENIUM	15.0
METALS	VANADIUM	2.6 J

MOB-07

METALS	ANALYTE	
METALS	BARIUM	72.8 J
METALS	CADMIUM	0.95 J
METALS	MERCURY	0.13
METALS	NICKEL	5.1 J
METALS	SELENIUM	3.2 J
METALS	ZINC	6.2 J

M12-04

METALS	ANALYTE	
METALS	ANTIMONY	3.5 J
METALS	ARSENIC	5.0 J
METALS	BARIUM	14.5 J
METALS	COPPER	3.8 J
METALS	MOLYBDENUM	3.1 J
METALS	VANADIUM	18.7 J

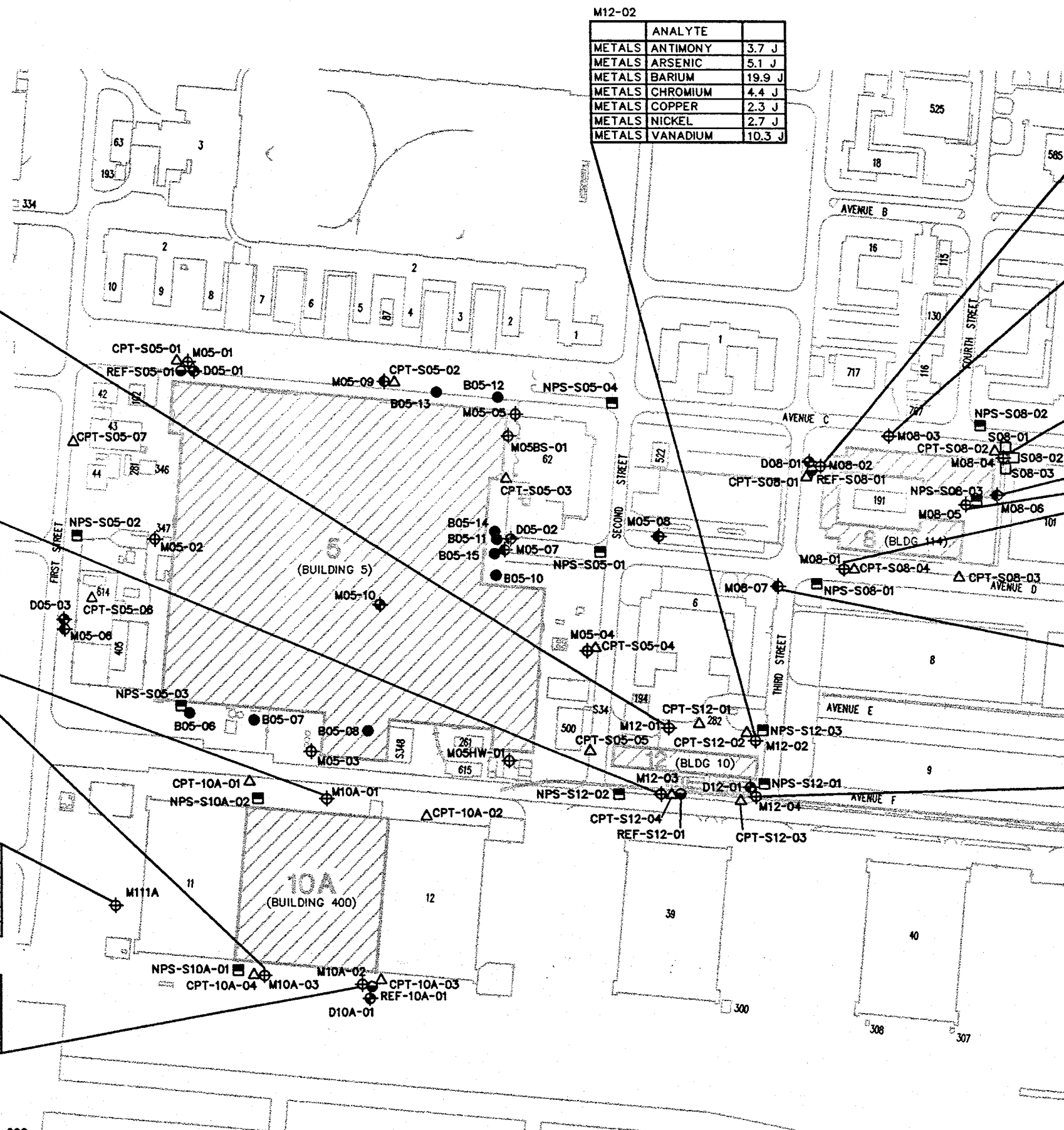
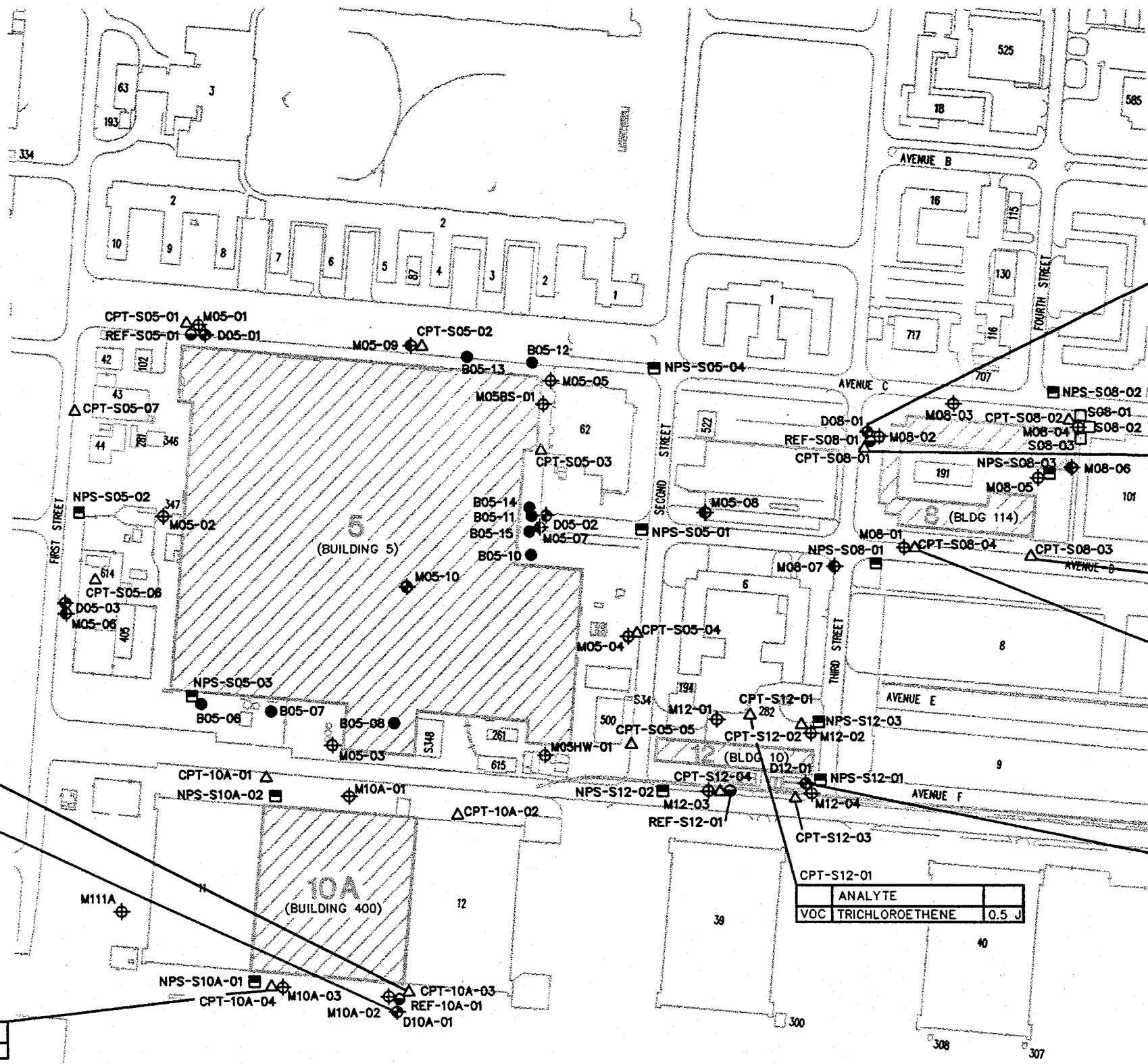


FIGURE 4-32
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 8, 10A, AND 12
1994 ANALYTICAL RESULTS FOR
TOTAL METALS
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE



CPT-10A-03		
ANALYTE		
VOC	BENZENE	0.1 J

D10A-01		
ANALYTE		
VOC	BENZENE	0.2 J
VOC	CARBON DISULFIDE	0.6 J
VOC	CHLOROFORM	0.3 J
VOC	TOLUENE	0.2 J

CPT-10A-04		
ANALYTE		
VOC	CARBON DISULFIDE	26

D08-01		
ANALYTE		
VOC	CARBON DISULFIDE	0.4 J
VOC	CHLOROFORM	0.8 J

CPT-S08-01		
ANALYTE		
VOC	BENZENE	0.2 J
VOC	CARBON DISULFIDE	0.1 J

CPT-S08-03		
ANALYTE		
VOC	BENZENE	0.2 J
VOC	CARBON DISULFIDE	6

CPT-S08-04		
ANALYTE		
VOC	BENZENE	0.2 J
VOC	TOLUENE	4
VOC	XYLENE (TOTAL)	4 J

D12-01		
ANALYTE		
VOC	1,1,1-TRICHLOROETHANE	0.6 J
VOC	CARBON DISULFIDE	0.7 J
VOC	CHLOROFORM	0.4 J

CPT-S12-01		
ANALYTE		
VOC	TRICHLOROETHENE	0.5 J

LEGEND

- SITE LOCATION
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

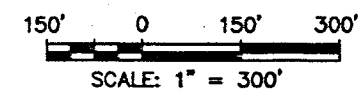


FIGURE 4-33
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 8, 10A, AND 12
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE



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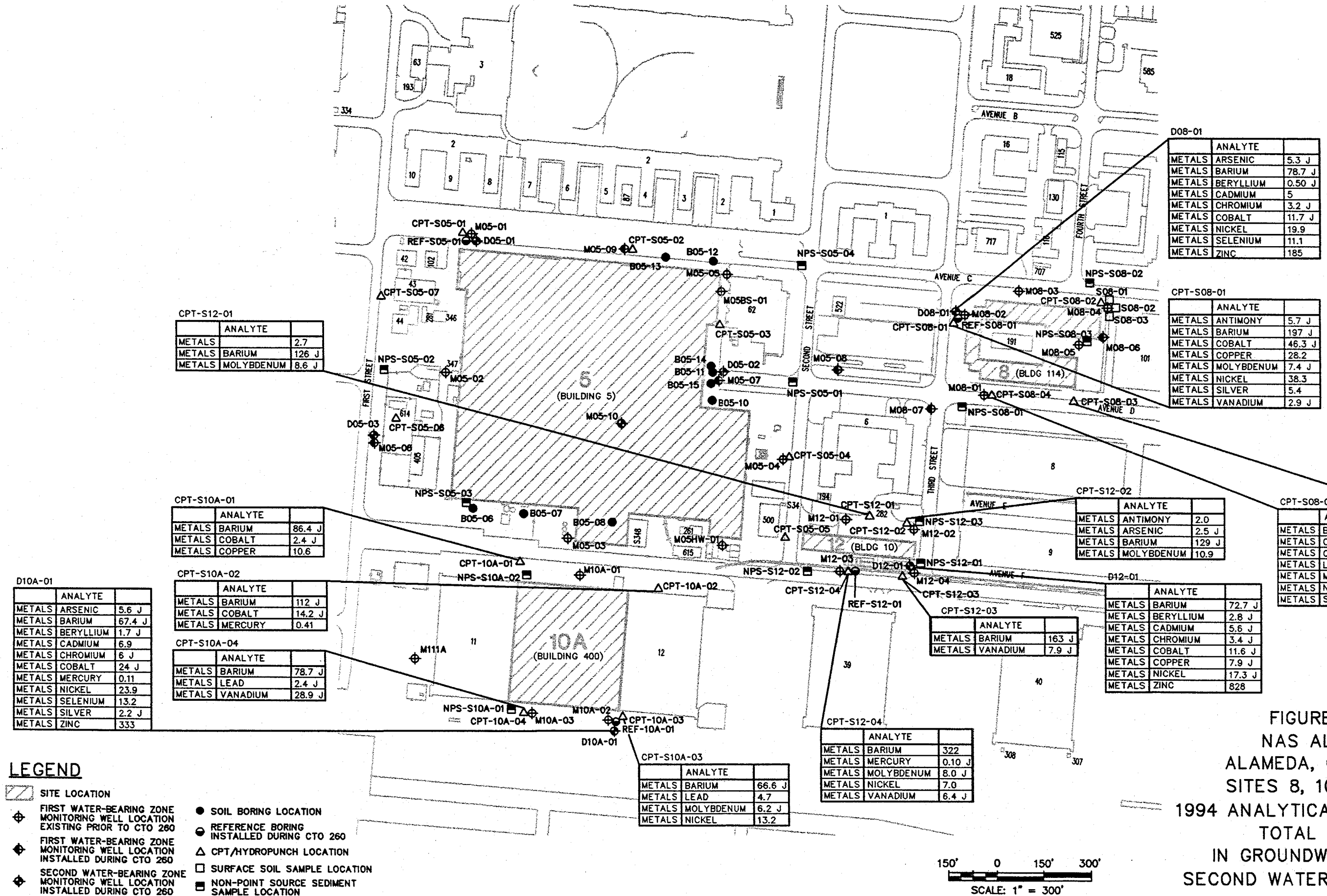
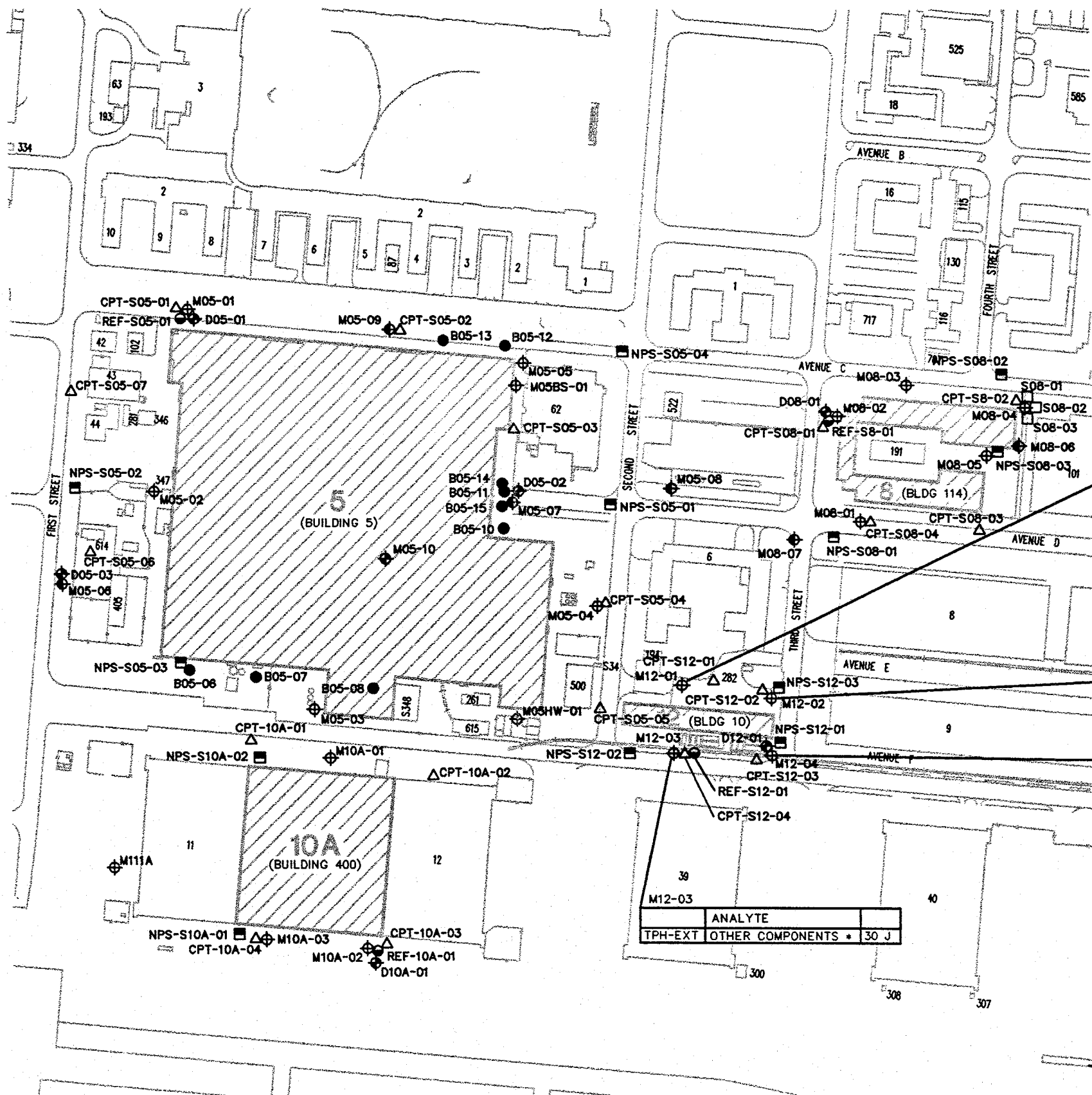


FIGURE 4-34
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 8, 10A, AND 12
1994 ANALYTICAL RESULTS FOR
TOTAL METALS
IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE



M12-01	
ANALYTE	
TPH-EXT	OTHER COMPONENTS * 120 J

M12-02	
ANALYTE	
TPH-EXT	OTHER COMPONENTS * 82 J
TPH-PURG	TPH-TOLUENE 0.5

M12-04	
ANALYTE	
TPH-EXT	OTHER COMPONENTS * 200 J

M12-03	
ANALYTE	
TPH-EXT	OTHER COMPONENTS * 30 J

LEGEND

- [Hatched Box] SITE LOCATION
- [Circle with Cross] FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- [Circle with Dot] FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- [Circle with Plus] SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- [Solid Circle] SOIL BORING LOCATION
- [Circle with X] REFERENCE BORING INSTALLED DURING CTO 260
- [Triangle] CPT/HYDROPUNCH LOCATION
- [Square] SURFACE SOIL SAMPLE LOCATION
- [Square with X] NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
* UNKNOWN HYDROCARBONS

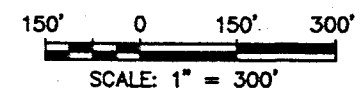
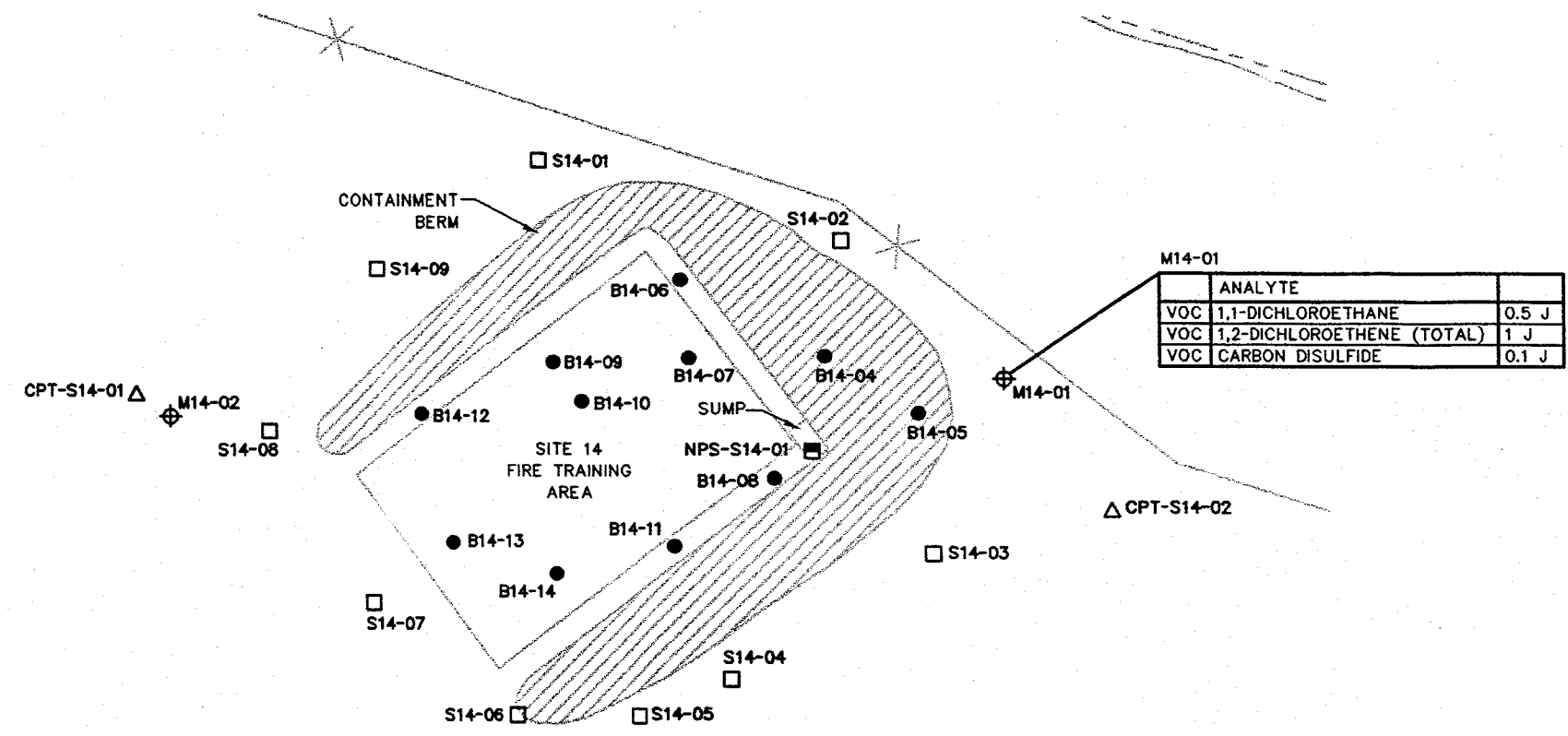


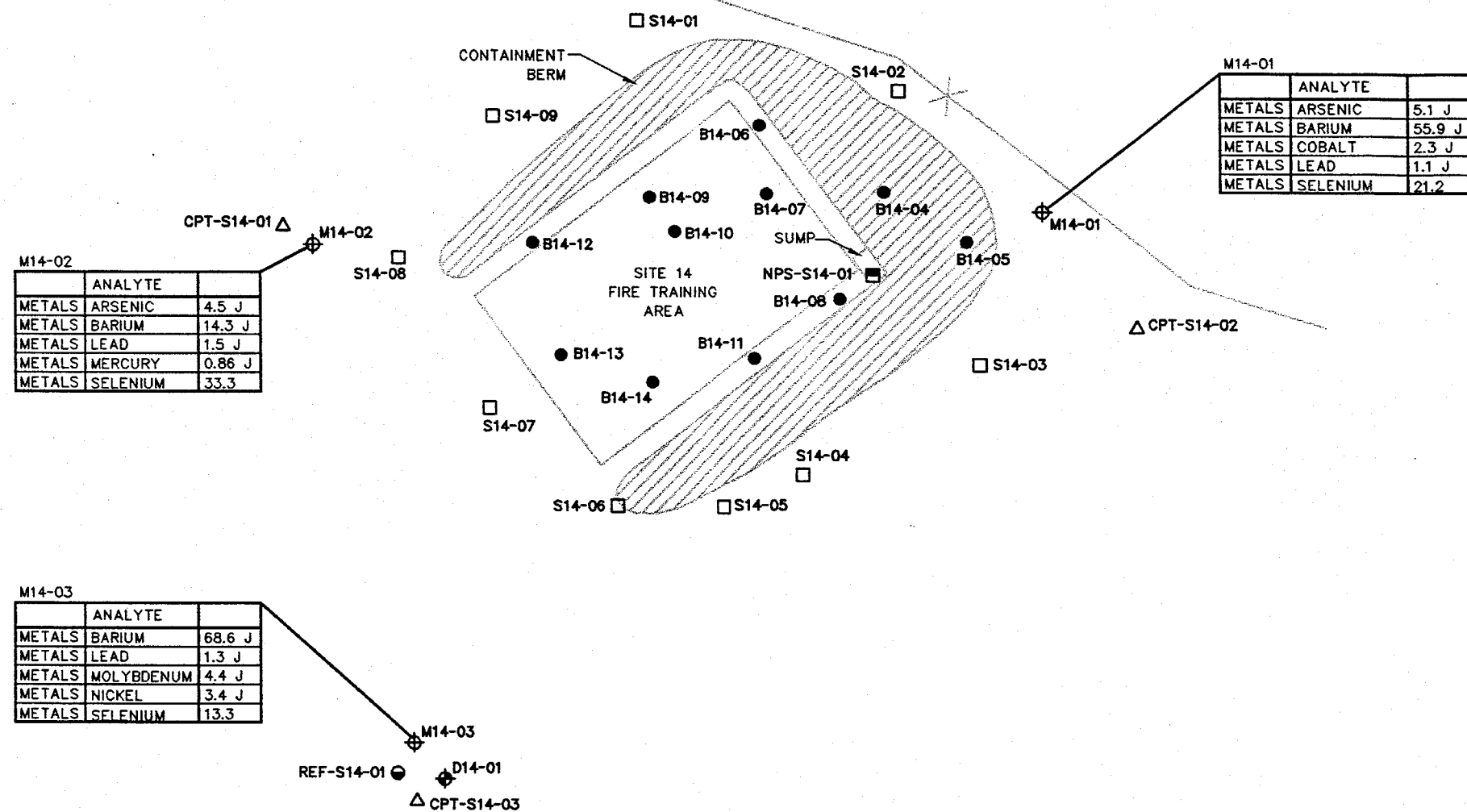
FIGURE 4-35
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 12
1994 ANALYTICAL RESULTS FOR
TOTAL PETROLEUM HYDROCARBONS
EXTRACTABLE AND PURGEABLE
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

FIGURE 4-36
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE

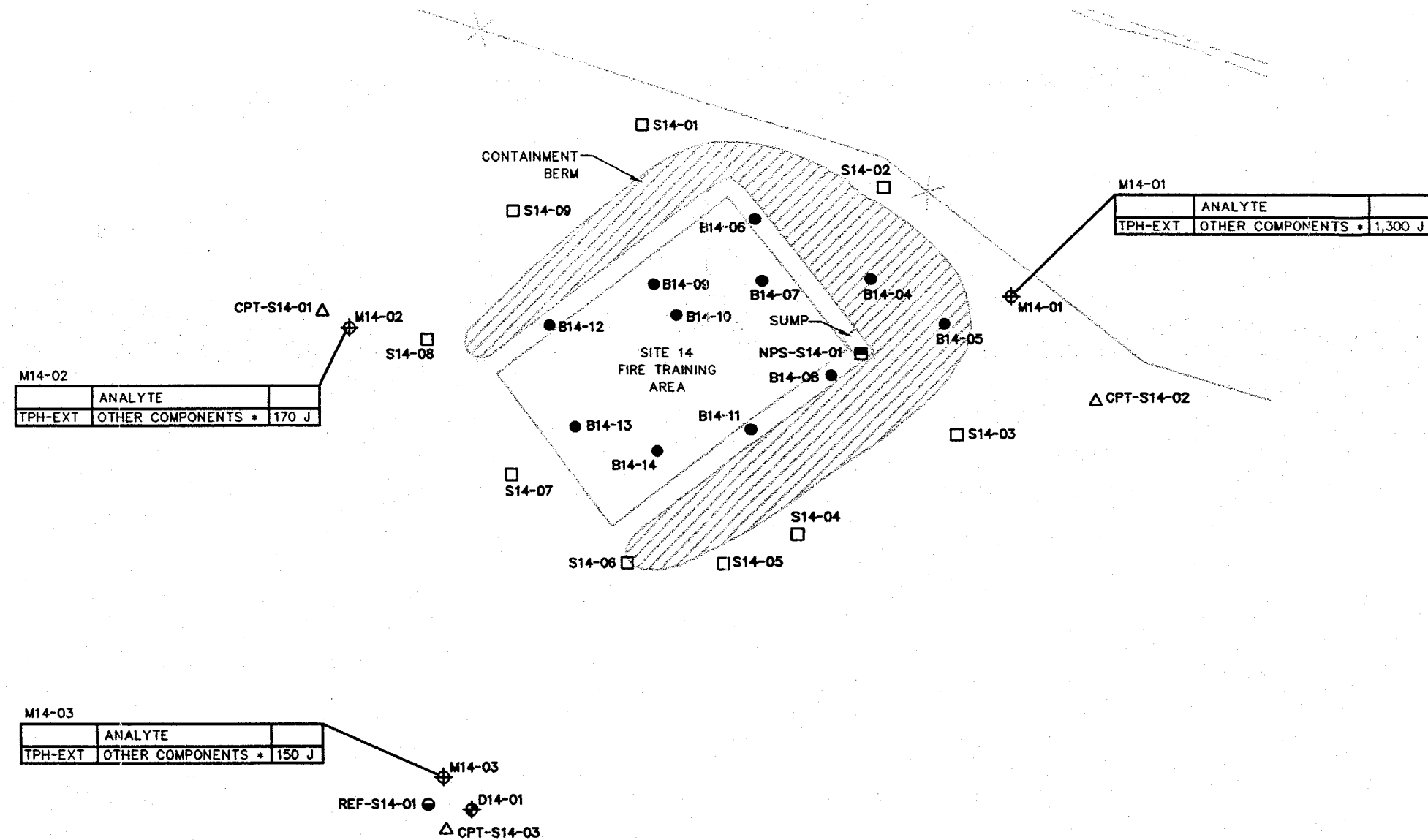


LEGEND

- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260

15' 0 15' 30'
SCALE: 1" = 30'

FIGURE 4-37
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
TOTAL METALS IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
* UNKNOWN HYDROCARBONS

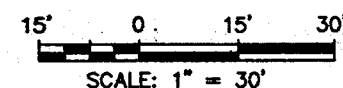
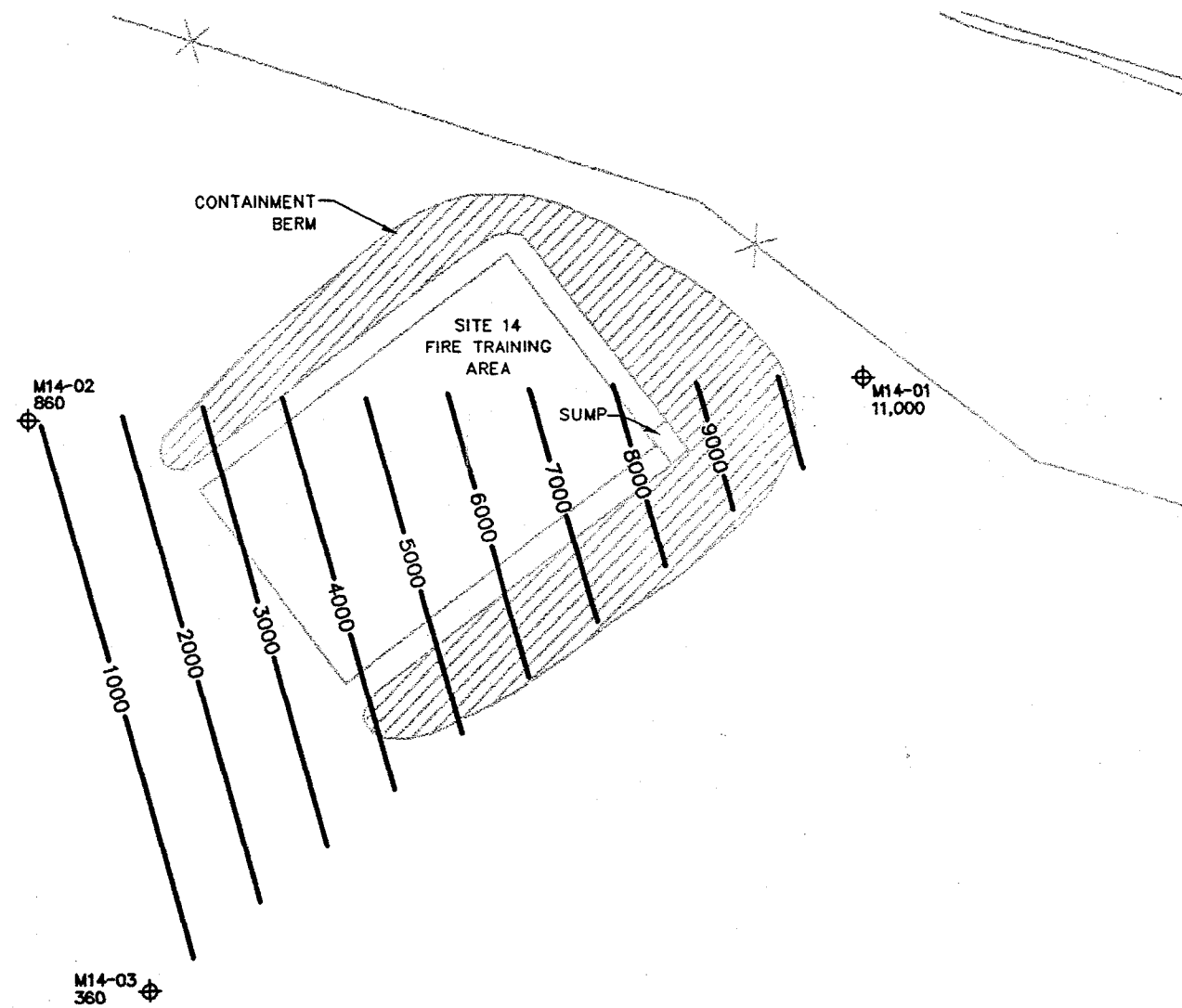


FIGURE 4-38
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
TOTAL PETROLEUM HYDROCARBONS
EXTRACTABLE AND PURGEABLE
IN GROUNDWATER ($\mu\text{g/L}$)
FIRST WATER-BEARING ZONE



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- 1000 — TOTAL DISSOLVED SOLIDS ISOCONTOUR
CONTOUR INTERVAL = 1000 mg/L

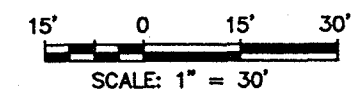


FIGURE 4-39
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14 - TOTAL
DISSOLVED SOLIDS (mg/L)
CONTOURS IN GROUNDWATER
FIRST WATER-BEARING ZONE



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DATE: 01/26/95
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LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

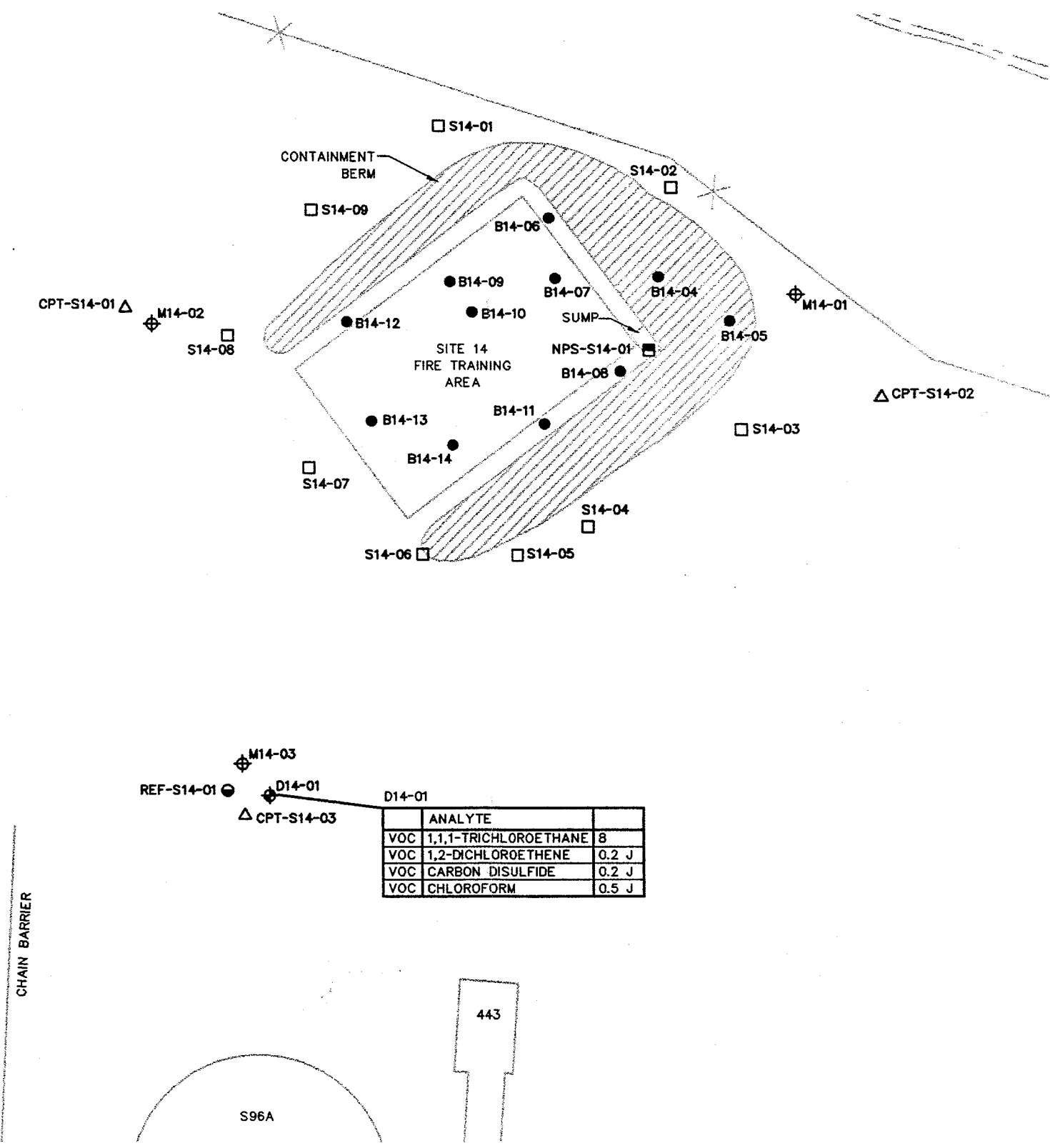
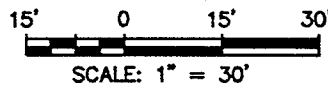


FIGURE 4-40
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE

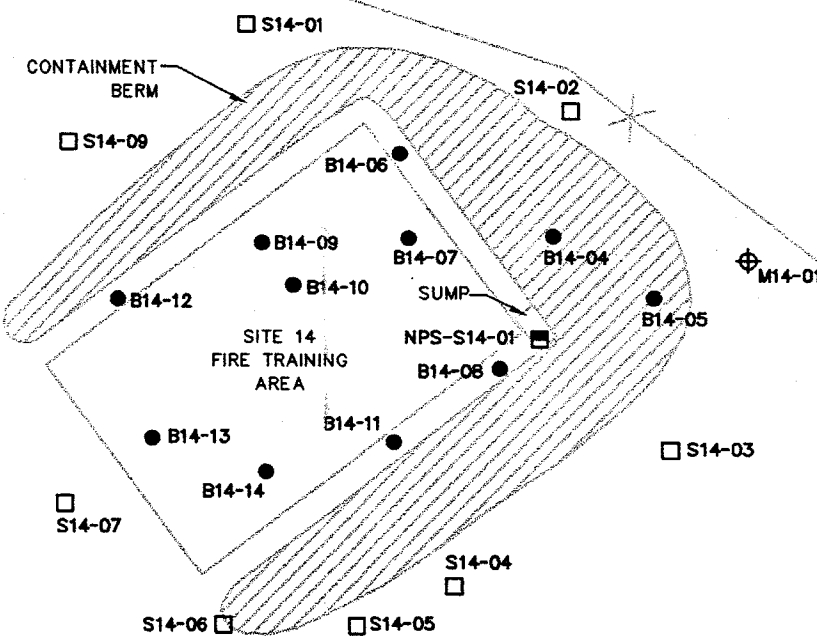




CPT-S14-01		
	ANALYTE	
METALS	BARIUM	273
METALS	COBALT	7.7 J
METALS	COPPER	93.2
METALS	LEAD	2.6 J
METALS	MERCURY	0.15
METALS	MOLYBDENUM	6.4 J
METALS	ZINC	66.2

D14-01		
	ANALYTE	
METALS	ARSENIC	9.2 J
METALS	BARIUM	81 J
METALS	CADMIUM	2.6 J
METALS	COPPER	8.3 J
METALS	NICKEL	5.5 J
METALS	SELENIUM	19.5 J
METALS	ZINC	53.5 J

CPT-S14-03		
	ANALYTE	
METALS	BARIUM	179 J
METALS	COBALT	9.8 J
METALS	COPPER	6.1
METALS	LEAD	1.4 J
METALS	MOLYBDENUM	11.3
METALS	SELENIUM	27.8 J
METALS	VANADIUM	4.4 J



LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

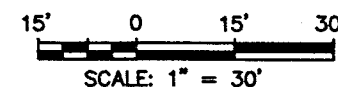


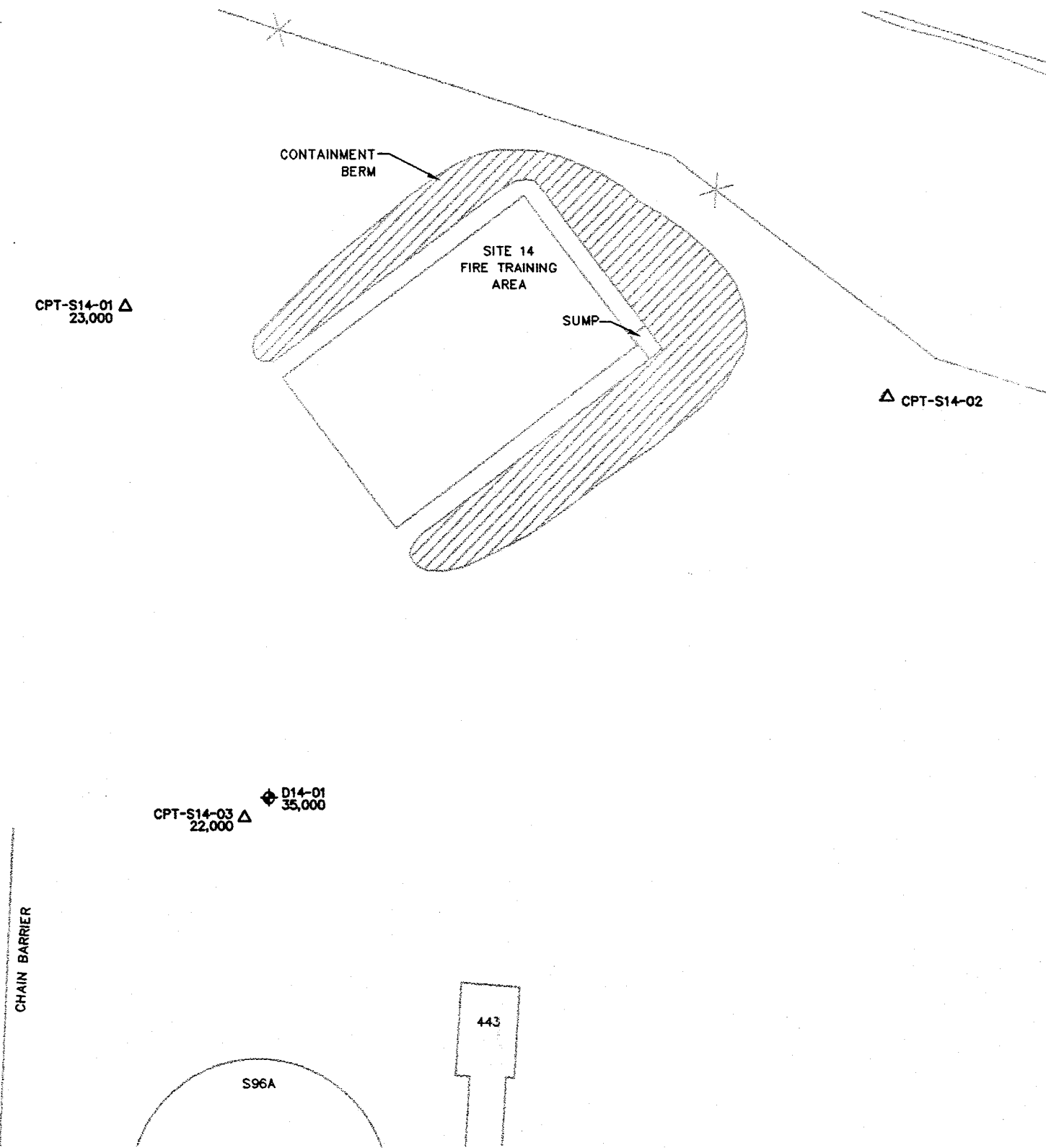
FIGURE 4-41
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
TOTAL METALS IN GROUNDWATER ($\mu\text{g/L}$)
SECOND WATER-BEARING ZONE



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DATE: 01/27/95

LEGEND

- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 260
- ⊕ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 260
- ⊕ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 280
- Δ CPT/HYDROPUNCH LOCATION
22,000 TDS CONCENTRATION (mg/L)



15' 0 15' 30'
SCALE: 1" = 30'

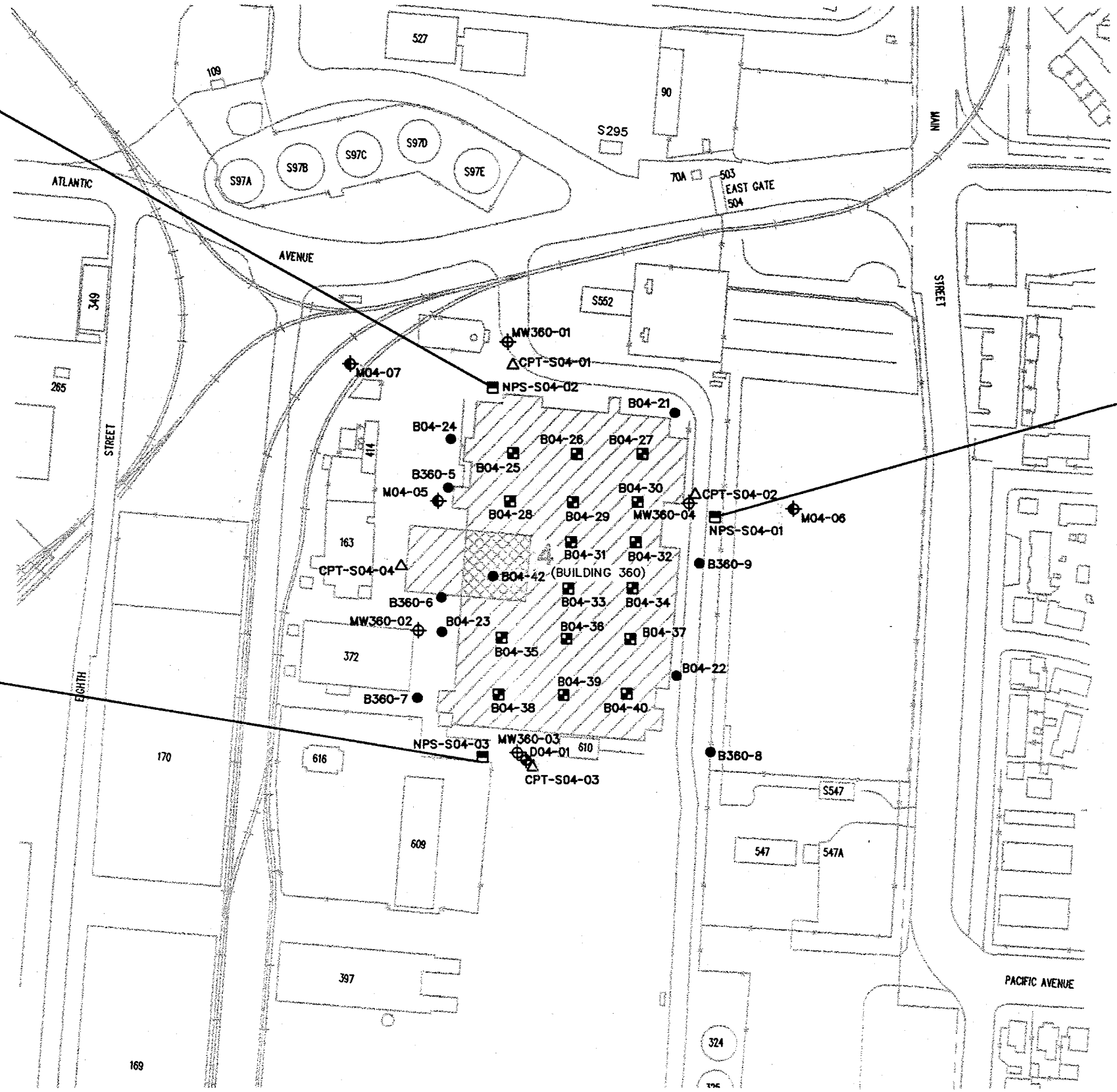
FIGURE 4-42
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
TOTAL DISSOLVED SOLIDS
IN GROUNDWATER (mg/L)
SECOND WATER-BEARING ZONE



NPS-S04-02		
ANALYTE	DEPTH 0.0'	
VOC 1,2-DICHLOROETHENE (TOTAL)	22	
VOC CHLOROBENZENE	7 J	
VOC TRICHLOROETHENE	4 J	
SVOC 1,4-DICHLOROBENZENE	56 J	
SVOC 2-METHYLNAPHTHALENE	50 J	
SVOC 2-METHYLPHENOL	53 J	
SVOC 4-METHYLPHENOL	16 J	
SVOC BIS(2-ETHYLHEXYL)PHTHALATE	8,000 J	
SVOC DIBENZOFURAN	17 J	
SVOC FLUORANTHENE	2,600 J	
SVOC NAPHTHALENE	36 J	
SVOC PHENOL	580 J	
SVOC PYRENE	120 J	
METALS CADMIUM	136	
METALS CHROMIUM	1,430	
METALS COPPER	497	
METALS NICKEL	7,430	
METALS SILVER	114	
TPH-EXT OTHER COMPONENTS *	80,000 J	
TPH-EXT MOTOR OIL (C16-C32)	1,900,000 J	
TPH-PURG OTHER COMPONENTS *	2,500 J	
CYANIDE CYANIDE	1.8	

NPS-S04-01		
ANALYTE	DEPTH 0.0'	
VOC CHLOROBENZENE	3,200	
METALS CADMIUM	15.6	
METALS CHROMIUM	202 J	
METALS LEAD	264	
METALS NICKEL	3,130 J	
TPH-EXT OTHER COMPONENTS *	20,000 J	
TPH-EXT MOTOR OIL (C16-C32)	1,000,000	
TPH-PURG OTHER COMPONENTS *	8,400 J	
CYANIDE CYANIDE	0.75 J	

NPS-S04-03		
ANALYTE	DEPTH 0.0'	
VOC 1,2-DICHLOROETHENE (TOTAL)	15 J	
VOC ETHYLBENZENE	6 J	
SVOC 2-METHYLNAPHTHALENE	1,900 J	
SVOC FLUORANTHENE	720 J	
METALS CADMIUM	54.6	
METALS CHROMIUM	409 J	
METALS COPPER	367 J	
METALS LEAD	304	
METALS NICKEL	1,720 J	
METALS SILVER	145 J	
TPH-EXT JP-5 (C8-C16)	610,000 J	
TPH-EXT MOTOR OIL (C16-C32)	1,500,000	
TPH-PURG OTHER COMPONENTS *	130,000 J	
CYANIDE CYANIDE	0.84 J	



- LEGEND**
- PLATING SHOP
 - SITE LOCATION
 - SHALLOW MONITORING WELL LOCATION EXISTING BEFORE CTO 260
 - SHALLOW MONITORING WELL LOCATION INSTALLED DURING CTO 260
 - DEEP MONITORING WELL LOCATION INSTALLED DURING CTO 260
 - SOIL BORING LOCATION
 - CPT/HYDROPUNCH LOCATION
 - SHALLOW SOIL SAMPLE LOCATION
 - NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTE:
METAL ANALYTES HAVING CONCENTRATIONS BELOW 10 TIMES THE SOLUBLE THRESHOLD LIMIT ARE NOT SHOWN ON THIS FIGURE.
METALS AND CYANIDE CONCENTRATIONS REPORTED IN mg/kg.
ALL OTHER CONCENTRATIONS REPORTED IN µg/kg.
* UNKNOWN HYDROCARBONS

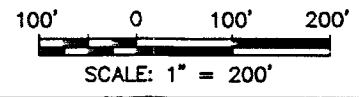


FIGURE 4-43
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 4
1994 ANALYTICAL RESULTS FOR
NON-POINT SOURCE UTILITY SAMPLES

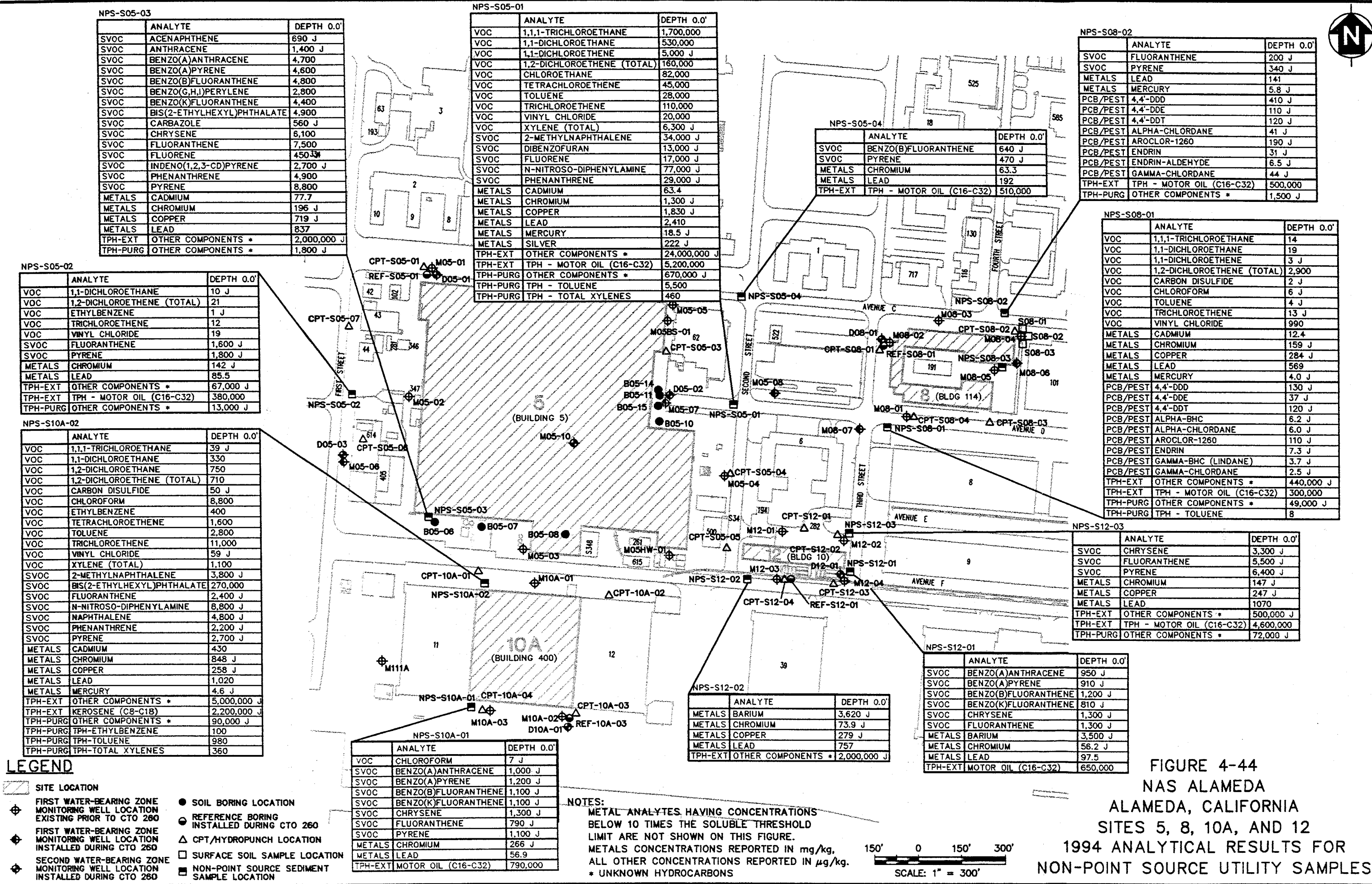
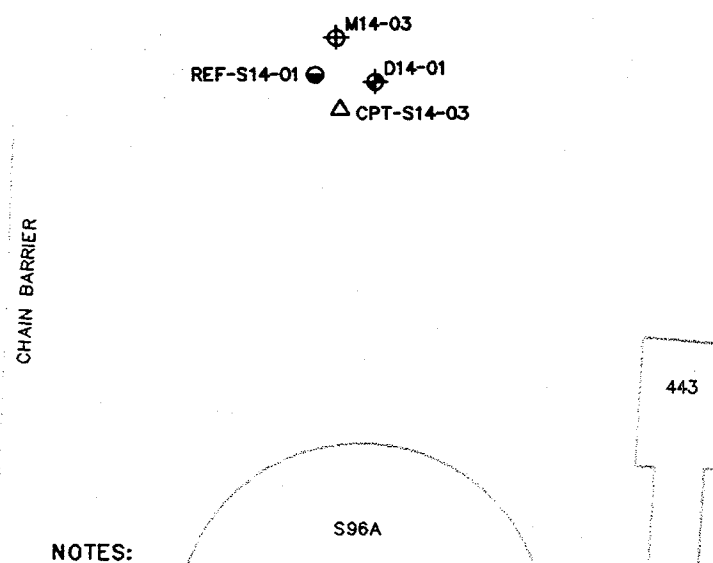
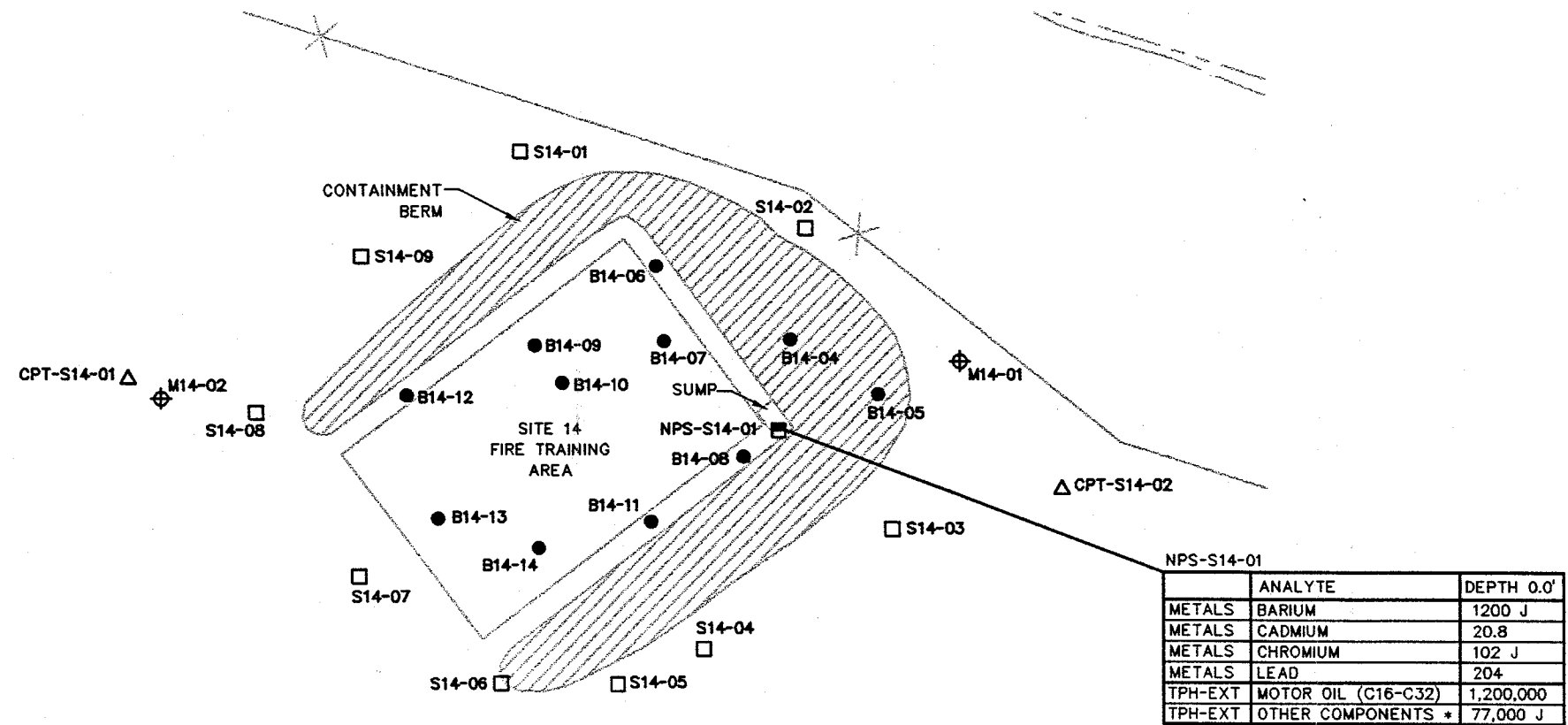


FIGURE 4-44
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITES 5, 8, 10A, AND 12
1994 ANALYTICAL RESULTS FOR
NON-POINT SOURCE UTILITY SAMPLES



LEGEND

- ◆ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION EXISTING PRIOR TO CTO 280
- ◆ FIRST WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 280
- ◆ SECOND WATER-BEARING ZONE MONITORING WELL LOCATION INSTALLED DURING CTO 280
- SOIL BORING LOCATION
- REFERENCE BORING INSTALLED DURING CTO 260
- △ CPT/HYDROPUNCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- NON-POINT SOURCE SEDIMENT SAMPLE LOCATION

NOTES:

METAL ANALYTES HAVING CONCENTRATIONS BELOW 10 TIMES THE SOLUBLE THRESHOLD LIMIT ARE NOT SHOWN ON THIS FIGURE.
METALS CONCENTRATIONS REPORTED IN mg/kg,
ALL OTHER CONCENTRATIONS REPORTED IN µg/kg.
* UNKNOWN HYDROCARBONS

15' 0 15' 30'
SCALE: 1" = 30'

FIGURE 4-45
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 14
1994 ANALYTICAL RESULTS FOR
NON-POINT SOURCE UTILITY SAMPLES

5.0 DATA QUALITY

The analytical program, data validation process, and data quality objectives (DQO) for the first quarterly groundwater samples, HydroPunch samples, and soil samples are established in the Phases 2B and 3 of the FSP (PRC and Montgomery Watson 1994) and Section 3.0 of the RI/FS work plan addendum (PRC and Montgomery Watson 1993c). The DQOs and the quality control (QC) program described in these documents provided the structure by which the chemical data results were reviewed. The data were evaluated with respect to the following five criteria: precision, accuracy, representativeness, completeness, and comparability (the PARCC criteria). This section is a summary of the data quality and is not intended as a quality control summary report. Details of the data validation and quality will be presented in quality control summary reports to be included in the RI reports. Section 5.1 summarizes the analytical program, Section 5.2 summarizes the data validation process, and Section 5.3 discusses the results of each PARCC criteria for the first quarterly monitoring of the CTO 0260 wells.

5.1 ANALYTICAL PROGRAM

The analytical methods are outlined in Section 3.6 of the RI/FS work plan addendum, and are described below:

- VOCs were analyzed by EPA contract laboratory program (CLP) special analytical services (SAS) volatile organic analysis (VOA) method (water and soil samples).
- SVOCs were analyzed by EPA CLP routine analytical services (RAS) semivolatile organic analysis (SVOA) method (water and soil samples).
- Organochlorine (OC) pesticides/PCBs were analyzed by CLP RAS PCBs/pesticides (PEST) method (water and soil samples).
- Polychlorinated dibenzo-p-dioxins and dibenzofurans were analyzed according to the CLP SAS Method B requirements for the 1989 EPA Method 8280 (soil samples).
- TPH-P was analyzed according to the California Leaking Underground Fuel Tank (LUFT) Manual (State Water Resources Control Board [SWRCB] 1989)-modified EPA Method 8015 (water and soil samples).
- TPH-E was analyzed according to LUFT-modified EPA Method 8015 (water and soil samples).

- Metals and cyanide were analyzed by EPA CLP metals and cyanide (METALS) method (water and soil).
- General chemical characteristics (acidity, alkalinity, biochemical oxygen demand [BOD], chemical oxygen demand [COD], hardness, Ph, total and dissolved sulfide, total dissolved solids [TDS], total suspended solids [TSS], turbidity, and total organic carbon [TOC]), and major anions (chloride, fluoride, sulfate, nitrate, and nitrate) were analyzed by various methods (water samples). Cation exchange capacity (CEC), Ph, total Kjeldahl nitrogen (TKN), TOC, and major anions were analyzed by various methods for soil samples.

All analytical work was performed by ETC/Mid-Pacific of Mountain View, California, and Analytical Technologies, Inc. of San Diego, California.

5.2 DATA VALIDATION

Data validation was performed by PRC, Triangle Laboratories, Luce and Associates, and ICF Kaiser. The quality of the sample data was evaluated based on field QC samples, laboratory QC samples, and method-specific QC parameters. Field QC samples consisted of field blank samples (source water), equipment rinsate blank samples (from decontamination activities), trip blank samples, and field duplicate samples. Laboratory QC samples included method blank samples, laboratory control samples (LCS), matrix spike/matrix spike duplicate samples (MS/MSD), and laboratory matrix duplicate samples. Method-specific QC parameters included analyte holding times, initial and continuing calibrations, post-digestion and method of standard addition (MSA) spike recoveries (metals), and internal and surrogate standard recoveries (organics), and other related QC parameters. As specified in the RI/FS work plan addendum, all data received cursory review (EPA Level III). In addition, 10 percent of the data were selected randomly for full validation (EPA Level IV). A detailed description of the procedures used for data validation are provided in the RI/FS work plan addendum. The following data qualifiers were used by the validators to qualify the reported detection limits and analyte concentrations. The definitions for these qualifiers are consistent with "National Functional Guidelines for Organic Data Review" (EPA 1990) and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses" (EPA 1988).

No Qualifier	-	Indicates that the reported concentration is acceptable both qualitatively and quantitatively.
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- U - Indicates compound was analyzed for but not detected above the concentration listed.
- J - Indicates an estimated concentration value. The result is considered qualitatively acceptable, but quantitatively unreliable.
- UJ - Indicates an estimated quantitation limit. The compound was analyzed for but was considered nondetected.
- R - Rejected. The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification.
- N - Indicates presumptive evidence of the presence of this analyte.

Eight qualifier comment codes were used to indicate the type of QC problem leading to the qualification of the data and are summarized below:

- a - Surrogate recovery outside specified control limits
- b - Contamination found in method blank or field blank samples
- c - Matrix spike recovery outside specified control limits
- d - Duplicate relative percent difference (RPD) for laboratory matrix duplicate, field duplicate, or MS/MSD outside specified control limits
- e - Internal standard recovery outside specified control limit
- f - Calibration criteria were not met
- g - Reported concentration is below the contract required quantitation limit (CRQL) or the contract required detection limit (CRDL)
- h - All other qualifications (i.e., exceeded holding times, serial dilution precision . . .)

The percentages of the data that were qualified using the above qualifiers and comment codes are summarized in Table 5-1 for water samples and in Table 5-2 for soil samples.

5.3

PARCC

Through the data validation process, the data were evaluated for acceptable quality and quantity, based on the critical indicator parameters of PARCC criteria. Objectives for these indicator parameters were developed for this project based on past experience and in the objectives of the RI/FS Work Plan Addendum and the Phase 2B and 3 FSP. Field procedures, analytical methods, and the project quality assurance/quality control (QA/QC) program were selected and developed to meet these objectives. The definitions for each PARCC criteria are presented in section 3.0 of the RI/FS Work Plan Addendum, and are discussed briefly below.

5.3.1

Precision

Precision refers to the reproducibility of measurements of the same characteristics, usually under a given set of conditions. Precision is expressed as the relative percent difference (RPD) of a duplicate pair. During the process of data validation, all field duplicate samples, matrix spike duplicate pairs, and laboratory matrix duplicate pairs were evaluated for compliance with the acceptance criteria for precision for each analytical method. Although field duplicate precision data was evaluated in each data validation report, no qualifications were made on the basis of field duplicate precision alone.

5.3.2

Accuracy

Accuracy refers to the degree in which a measured value agrees with the true value. Errors introduced into the measurement system through sample matrix effects, sample preparation, laboratory contamination, and poor analytical techniques can have an impact on accuracy. The accuracy of each analytical result was evaluated through the analysis of initial and continuing calibrations, matrix spike samples, laboratory control samples, post-digestion and MSA recoveries, internal and surrogate recoveries, and method blanks.

5.3.3

Representativeness

Representativeness is a qualitative expression of the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an

environmental condition. Sample results were evaluated for representativeness by examining items related to the collection of samples, such as the adherence to specified sampling locations and sample quantities, sampling techniques and sample handling procedures, and the chain-of-custody documentation. Also examined were laboratory procedures, including adherence to specified analytical methodologies, holding time constraints, and reported quantitation limits. Any parameters that adversely affected the representativeness of a sample result are documented in the validation reports.

Field blank, equipment rinsate blank, trip blank, and method blank results were evaluated during the data validation process to determine whether field conditions, decontamination procedures, travel conditions, or laboratory conditions may have affected the sample results.

5.3.4 Completeness

Completeness is defined as the percentage of measurements that are judged to be valid compared to the entirety of the data needed for the project. The project completeness was calculated by dividing the number of complete, valid sample results (those not qualified as rejected), by the total number of samples planned for analysis. The completeness goal of 90 percent, as stipulated in the RI/FS work plan addendum, was met for this part of the project. For the water samples, 99.1, 95.4, and 99.8 percent of the data for SVOCs, metals, and VOCs, respectively, and 100 percent for all other parameters are valid. For the soil samples, 99.8 and 99.9 percent of the data for SVOCs and metals, respectively, and 100 percent for all other parameters are valid.

5.3.5 Comparability

Comparability of the data is a qualitative expression of the confidence with which one data set may be compared to another. Comparability of the data was achieved by the use of standard methods of analysis, quantitation limits, and the standardized data validation procedures. Soil results for all analytical methods were reported in dry weight units (adjusted for moisture content). Quantitation limits within a method varied slightly from sample to sample due to the adjustments for moisture content.

Soil and water quantitation limits for several analytes in methods SVOC, VOC, and metals were lowered due to a request from the Department of Toxic Substances Control (DTSC) and the RWQCB. Quantitation limits for all other analytes reported by the laboratory were those defined by Section 3.0 of the RI/FS work plan addendum. The two project laboratories were unable to meet the CRDL for mercury of 0.0036 mg/kg for soil, and 0.025 $\mu\text{g/L}$ for water. The instrument detection limits (IDL) reported by the laboratories for mercury in soil and water are 0.05 mg/kg and 0.1 $\mu\text{g/L}$, respectively.

All elevated reporting limits were assessed during the data validation process to determine if there was a justifiable reason for the raised limits. Reporting limits were frequently raised due to high concentrations of target or interfering compounds. In these cases, sample extracts are diluted and analyzed, or a smaller aliquot of original sample is analyzed, resulting in some non-detected target analytes being reported at higher than normal detection limits. Through the data validation process, the reporting limits for these samples were judged to be acceptable.

TABLE 5-1

**CTO 260 NAS ALAMEDA
PERCENTAGE OF QUALIFIED DATA
FIRST QUARTER GROUNDWATER SAMPLES AND HYDROPUNCH SAMPLES**

Method	Percentage of Qualified Data at Estimated Concentrations							
	a	b	c	d	e	f	g	h
VOCs								
TAL	0.0	4.3	0.0	0.0	0.0	4.3	2.6	0.3
TICs	0.0	4.0	0.0	0.0	0.0	0.0	2.0	1.0
SVOCs								
TAL	1.8	1.6	0.0	0.0	0.1	10	1.0	1.4
TICs	0.0	3.2	0.0	0.0	0.0	0.0	0.0	1.4
OC Pesticides and PCBs	86	0.0	0.0	0.0	0.0	0.0	0.3	0.3
TPH-Purgeable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
TPH-Extractable	3.3	0.0	0.0	0.0	0.0	2.2	1.7	12
Metals and Cyanide								
Metals	0.0	11	7.5	0.0	0.0	1.7	16	11
Cyanide	0.0	5.9	0.0	0.0	0.0	0.0	0.0	5.9
General Chemistry Characteristics								
Acidity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkalinity	0.0	0.0	23	31	0.0	0.0	0.0	2.1
BOD and COD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardness	0.0	0.0	0.0	15	0.0	16	0.0	0.0
pH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27
TDS, TSS, and Turbidity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4
TOC	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0
Total Sulfide	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Major Anions	0.0	0.5	3.2	0.0	0.0	0.9	0.0	14

BOD - Biochemical oxygen demand

COD - Chemical oxygen demand

OC Pesticides - Organochlorine pesticide

PCB - Polychlorinated biphenyl

pH - Log of the hydrogen ion concentration

SVOC - Semivolatile organic compound

TAL - Target analyte list

TDS - Total dissolved solids

TIC - Tentatively identified compound

TOC - Total organic carbon

TPH - Total petroleum hydrocarbon

TSS - Total suspended solids

VOC - Volatile organic compound

a - Surrogate recovery outside control limits (accuracy)

b - Contamination found in the blank sample (accuracy)

c - Matrix spike recovery outside control limits (accuracy)

d - Duplicate relative response difference outside control limit (precision)

e - Internal standard recovery outside control limits (accuracy)

f - Calibration criteria not met (accuracy)

g - Quantification less than quantitation limit (accuracy)

h - All other qualifications

TABLE 5-2

**CTO 260 NAS ALAMEDA
PERCENTAGE OF QUALIFIED DATA SOIL SAMPLES**

Method	Percentage of Qualified Data at Estimated Concentrations							
	a	b	c	d	e	f	g	h
VOCs								
TAL	0.0	3.4	0.0	0.0	0.0	1.9	2.0	0.1
TICs	0.0	0.4	0.0	0.0	0.0	0.0	0.0	7.4
SVOCs								
TAL	0.0	1.2	0.1	0.0	0.1	7.8	3.4	13
TICs	0.0	9.4	0.0	0.0	0.0	0.0	0.0	1.5
OC Pesticides and PCBs	25	0.0	0.0	0.0	0.0	0.0	0.0	11
Dioxins/Furans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TPH-Purgeable	0.1	0.0	0.0	0.0	0.0	0.0	0.2	4.2
TPH-Extractable	10	0.0	0.0	0.0	0.0	8.8	2.3	21
Metals and Cyanide								
Metals	0.0	3.7	8.7	3.5	0.0	0.0	16	9.3
Cyanide	0.0	23	3.8	0.0	0.0	0.0	3.8	30
General Chemistry Characteristics								
CEC	0.0	0.0	0.0	28	0.0	0.0	0.0	0.0
pH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TKN	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
TOC	0.0	0.0	0.0	1.9	0.0	0.0	0.0	50

CEC - Cation exchange capacity

OC Pesticides - Organochlorine pesticide

PCB - Polychlorinated biphenyl

pH - Log of the hydrogen ion concentration

SVOC - Semivolatile organic compound

TAL - Target analyte list

TIC - Tentatively identified compound

TKN - Total Kjeldahl nitrogen

TOC - Total organic carbon

TPH - Total petroleum hydrocarbon

VOC - Volatile organic compound

a - Surrogate recovery outside control limits

b - Contamination found in the blank sample

c - Matrix spike recovery outside control limits

d - Duplicate relative response difference outside control limit

e - Internal standard recovery outside control limits

f - Calibration criteria not met

g - Quantification less than quantitation limit

h - All other qualifications

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section briefly summarizes the background information including additional investigations and sampling conducted at IRP Sites 4, 5, 8, 10A, 12, and 14 under CTO 0260. Recommendations for additional field efforts based on the most recent and previous findings are also included. Sufficient site characterization data are available to complete the RI/FS evaluation. However, uncertainties associated with groundwater findings at Sites 4 and 5 may necessitate additional study.

6.1 SUMMARY OF BACKGROUND AND FIELD ACTIVITIES

The PRC team conducted field activities at six sites at NAS Alameda, pursuant to the Phases 2B and 3 FSP and as contracted under CTO 0260. Additional investigation and sampling were recommended at IRP Sites 4, 5, 8, 10A, 12, and 14 based on findings from earlier studies conducted at the six sites. The additional sampling was conducted from January to June 1994 (with quarterly groundwater sampling still in progress) to evaluate the nature and extent of organic compounds and metals in the soil and groundwater, in order to complete the RI/FS.

Geologic and analytical results from previous investigations, as well as this investigation, were used to evaluate if sufficient data was collected to complete an RI/FS. Initial RI/FS field activities were performed by the PRC team in 1991 at Sites 5, 8, 10A, 12, and 14 (PRC and JMM 1992b), and by Canonic Environmental in 1989 at Site 4 (PRC and Montgomery Watson 1993b). Supplemental work was conducted by the PRC team at Site 4 in 1992 and at Site 5 in 1992 and 1993 (PRC and JMM 1992a). Earlier investigations were also conducted at Site 4 in 1981, 1982, and 1989.

The current investigation included collecting and analyzing samples from shallow soils and shallow groundwater beneath and around the six sites. Sediment samples were also collected from selected storm drain catch basins and storm drain manholes at each site to assess the potential for these utilities to act as contaminant sources or to transport chemicals off site. Field activities included CPT and HydroPunch sampling, NPS sampling, surface soil sampling, shallow soil boring and soil sampling, shallow and deep monitoring well installation, and quarterly groundwater sampling (including groundwater level measurements). Field activities were performed in accordance with the Phases 2B and 3 FSP. The only exceptions were, one CPT location that was not completed at Site 4; two

HydroPunch samples that were not obtained at Sites 4 and 14; and an NPS sample that was not obtained at Site 8.

6.2 SUMMARY OF LITHOLOGIC FINDINGS

Lithologic findings were similar to findings from earlier investigations for Sites 5, 8, 10A, 12, and 14. The current investigation supports previous investigations, which identified three major geologic units at NAS Alameda as shown on Figure 2-2. The current investigation identified an uppermost unit comprising the first water-bearing zone, which consists of an approximately 10-foot-thick fill layer. A semi-confining layer referred to as the Holocene Bay Mud comprises the second unit and underlies the first water-bearing zone. This unit varied in thickness from 25 feet thick at Site 14 to as thick as 70 feet at Site 8. The geology around Site 4 is the only variance from the initial conceptualized geology, indicating the absence of a Holocene Bay Mud unit, and putting the second water-bearing zone in direct hydraulic connection with the first water-bearing zone. The third unit is the second water-bearing zone, referred to as the Merritt Sand, which underlies the Holocene Bay Mud (or, at Site 4, directly underlies the fill).

6.3 SUMMARY OF ANALYTICAL FINDINGS

A summary of the analytical results of the soil sampling and the first quarter groundwater monitoring is presented below.

Site 4

- **Soil.** Low levels of VOCs were detected in 17 of the 24 soil sample locations from beneath and around the perimeter of Building 360. The detected VOCs were generally xylenes and ethylbenzene, and were detected more often during this investigation than in previous ones. Low levels of the PAH class of SVOCs were detected in 13 sample locations. The presence and concentrations of SVOCs detected during this investigation were generally consistent with past studies; slightly elevated PAH compounds were detected in a soil boring northeast of Building 360. Low levels of cyanide were detected at two locations beneath the southern portion of Building 360. Earlier investigations detected higher concentrations of cyanide beneath the plating shop and at a greater frequency. Several metals exceeded the 95/95 STI at three of the sampling locations at Site 4, to the southeast and northwest of Building 360 and beneath the plating shop. Lead exceeded 10 times the STLC at one location

northwest of Building 360. Elevated levels of TPH-E were detected west of and beneath Building 360; previous investigations did not analyze for TPH-E.

- **Shallow Groundwater.** VOCs were detected in groundwater from the first water-bearing zone in each of the seven monitoring wells. TCE and 1,2-DCE were detected most frequently and at the highest concentrations on the east side and north-northwest perimeter of Building 360. Elevated levels of vinyl chloride were detected east of the building, and elevated levels of 1,1,1-TCA, 1,1-DCA, and 1,1-DCE were detected to the west of Building 360. Low levels of SVOCs (PAH class) were detected at five of the seven shallow sampling locations around the building. Metals exceeded the 95/95 STI at five locations around the building, and cyanide was detected in only one location, west of Building 360. Previous investigations did not detect the presence of cyanide. Low levels of TPH-P and TPH-E were detected at six locations, with slightly elevated concentrations detected west of Building 360 in MW360-04.
- **"Deep" Groundwater.** Low levels of carbon disulfide and TPH-E as "other components" were detected in the deep groundwater sample obtained from D04-01. Previous investigations did not sample the deeper water-bearing zone at Site 4.
- **Non-Point Source.** Three NPS samples were collected from Site 4. The compounds detected were primarily SVOCs, petroleum hydrocarbons, cyanide, and metals.

Site 5

- **Soil.** Low levels of VOCs were detected in four of the seven soil sampling locations at Site 5. The compounds detected on the east side of Building 5 were primarily chlorinated compounds such as 1,1,1-TCA, 1,1-DCA, 1,1-DCE, and TCE. Low levels of xylenes and benzene were detected on the west side of the building. Similar compounds at higher concentrations were detected on the east and west sides of Building 5 during the earlier investigation.
- **Groundwater - First Water-Bearing Zone.** VOCs were detected in groundwater from the first water-bearing zone in all 11 monitoring wells. The primary VOCs detected include PCE, TCE, 1,2-DCE, 1,1,1-TCA, 1,1-DCA, 1,1-DCE, and vinyl chloride. Elevated levels of TCE were detected in monitoring wells east and south of Building 5. Elevated levels of 1,1,1-TCA were detected in monitoring wells east of Building 5 and beneath Building 5, and elevated levels of vinyl chloride were detected in monitoring wells around the perimeter of Building 5. The types and concentrations of VOCs detected are consistent with the previous investigation, except for an increase of VOC concentrations east of Building 360, in MW360-04. The low levels of SVOCs detected around the perimeter of Building 5 were similar and concentrations were comparable to the previous investigation, except for south of Building 5, where the types of compounds differ, and concentrations have increased. Metals exceeding the 95/95 STI were detected in nine locations around the building. Cyanide was detected in three locations; south and southeast of Building 5, and one location from

beneath the building. Cyanide was also detected south of the building during the previous investigation.

- **Groundwater - Second Water-Bearing Zone.** Low levels of chloroform were detected in two of the three monitoring wells in the second water-bearing zone at Site 5. Low levels of carbon disulfide were detected in three of the second water-bearing zone wells.
- **Non-Point Source.** Four NPS samples were collected from Site 5. The compounds detected were primarily VOCs, SVOCs, petroleum hydrocarbons, and metals.

Site 8

- **Soil.** Low levels of VOCs (ethylbenzene and xylenes) were detected in two of five soil sample locations from the northeast and southwest corner of Site 8. Low levels of PAH-related SVOCs were detected in one soil boring from the southwest corner of Site 8. The types and concentrations of VOCs and SVOCs detected are generally consistent with the previous investigation. Slightly elevated levels of PCBs were detected at three surface soil locations northeast of Building 114, consistent with the previous investigation. Low levels of pesticides to the northeast of Building 114 indicated a decrease from the previous investigation. Metals exceeded the 95/95 STI at three locations and lead exceeded 10 times the STLC at the same three locations northeast of Building 114.
- **Groundwater - First Water-Bearing Zone.** Low levels of VOCs (mostly BTEX) and SVOCs (mostly naphthalene) were detected in groundwater from the first water-bearing zone in six of the seven monitoring wells. The types of compounds and concentrations are consistent with the previous investigation, except for south of the building, where SVOC concentrations have increased. There were metals exceeding the 95/95 STI in each of the seven monitoring wells.
- **Groundwater - Second Water-Bearing Zone.** Low levels of carbon disulfide and chloroform were detected in the groundwater sample obtained from monitoring well D08-01, installed in the second water-bearing zone.
- **Non-Point Source.** Two NPS samples were collected from Site 8. The compounds detected were primarily VOCs, PCB/pesticides, and metals.

Site 10A

- **Soil.** There were no soil samples collected at Site 10A as part of the current investigation.

- **Groundwater - First Water-Bearing Zone.** Low levels of VOCs (primarily TCE, 1,2-DCE, 1,1-DCA, and 1,1-DCE) were detected in three of the four monitoring wells at Site 10A, mostly at the north and southwest ends of the site. SVOCs (chlorinated ethers) were detected in one of the shallow monitoring wells north of the site. The current concentrations and types of VOCs and SVOCs are generally consistent with the previous investigation. There were metals exceeding the 95/95 STI in each of the four monitoring wells.
- **Groundwater - Second Water-Bearing Zone.** Low levels of benzene, carbon disulfide, toluene, and chloroform were detected in the second water-bearing zone monitoring well, D10A-01.
- **Non-Point Source.** Two NPS samples were collected from Site 10A. The compounds detected were primarily VOCs, SVOCs, metals, and TPH.

Site 12

- **Soil.** There were no soil samples collected at Site 12 as part of the current investigation.
- **Groundwater - First Water-Bearing Zone.** Low levels of VOCs (benzene, toluene, and PCE) were detected in two wells north of Building 10, and low levels of SVOCs (primarily PAH compounds) were detected in two shallow wells northeast and south of Building 10. Only one VOC was detected during the previous investigation (1,1-DCE); however, current SVOC types and concentrations are similar to the previous investigation. Low levels of TPH were detected in three of the wells as "other components" north and south of Building 10. The TRPH analysis was conducted during the previous investigation. Metals exceeding the 95/95 STI were detected in two of the shallow monitoring wells.
- **Groundwater - Second Water-Bearing Zone.** Low levels of the VOCs 1,1,1-TCA, carbon disulfide, and chloroform were detected in the second water-bearing zone monitoring well, D12-01.
- **Non-Point Source.** Two NPS samples were collected from Site 12. The compounds detected were primarily SVOCs, metals, and TPH.

Site 14

- **Soil.** VOCs (primarily ethylbenzene and xylenes) were detected in 4 of 20 soil sampling locations within the bermed area, more elevated concentrations were noted toward the southern end of inside the bermed area. The previous investigation detected elevated levels of benzene, ethylbenzene, toluene, and xylenes from a soil gas survey. Elevated levels of TPH-P as "other components" were detected more

frequently in borings from within the bermed area. TPH-E was detected in all of the soil sample locations, with the more elevated concentrations reported in samples from the northern and southwestern portions of the bermed area, and from the west and southwest locations outside of the bermed area. Pesticides were detected in all of the surface soil samples, and PCBs and dioxins were detected in six of the surface soil samples. Dioxin and pesticide concentrations were highest in samples collected south of the bermed area, and PCB concentrations were highest in samples collected southeast of the bermed area. The VOC, pesticide, and PCB concentrations are consistent with previous studies; however, dioxin was not an analyte during the previous investigation. The TRPH analysis was run during the previous investigation, and not TPH-P or TPH-E.

- **Groundwater - First Water-Bearing Zone.** Low levels of VOCs (1,1-DCA, 1,1-DCE, carbon disulfide, and chloromethane) were detected in two of the three monitoring wells from the first water-bearing zone. The compound 1,2-DCE was detected at similar concentrations during the previous investigation, except that VOCs were not previously detected in the monitoring well south of the bermed area. Low levels of TPH-E as "other components" were detected in the two monitoring wells south and west of the bermed area; the TPH-E concentrations were slightly elevated in the monitoring well north of the bermed area. Metals exceeding the 95/95 STI were detected in each of the three wells.
- **Groundwater - Second Water-Bearing Zone.** Low levels of VOCs (TCA, 1,1-DCE, carbon disulfide, and chloroform) were detected in the second water-bearing zone from monitoring well D14-01.
- **Non-Point Source.** One NPS sample was collected from Site 14. Elevated levels of lead and TPH were detected.

6.4 RECOMMENDATIONS

Based on the findings from this investigation and from previous investigations, it appears that there are sufficient data to evaluate the nature and extent of chemicals of interest in soil and in groundwater in the second water-bearing zone at each of the six sites. Groundwater in the first water-bearing zone at two sites requires additional investigation. No further work is recommended for soil and groundwater in the second water-bearing zone. The findings, however, do not include the evaluation of potential risk at each site, which will be conducted during the RI. If a health or environmental risk exists, the need for additional investigation will be further evaluated.

Four of the six sites (8, 10A, 12, and 14) have adequate data to assess potential chemicals of interest in first water-bearing zone groundwater based on observation and a non-risk-related review of the

data. The remaining two sites, Sites 4 and 5, require additional groundwater investigation in the first water-bearing zone. Based on these findings, general recommendations for each site are presented below.

Site 4

- The nature and extent of potential chemicals of interest in soils at Site 4 appears to have been adequately evaluated for the purpose of conducting an RI/FS. It is recommended that no further soil sampling be conducted at Site 4. If a health or environmental risk exists, the need for additional investigation will be evaluated.
- A TCE source may exist at the north-northeast corner of Building 360, in the vicinity of MW360-04. Based on the flow direction established from the first quarter groundwater sampling (west to northwest groundwater flow direction), and considering past and future groundwater quality data from an abutting site to the northwest (there were no VOCs detected during the previous investigations at Site 3, which is located to the northwest of Site 4), TCE in the shallow groundwater appears to be adequately assessed in all directions except to the north of MW360-4 (north of B04-21), southeast of MW360-04, and west of Building 360. Soil and HydroPunch groundwater samples are recommended in order to evaluate the lateral and vertical extent of TCE north of B04-21 and southeast of MW360-04 (approximately due west of B04-22). Further soil and HydroPunch groundwater sampling is also recommended west and southwest of MW360-02 to evaluate the lateral and vertical extent of 1,1,1-TCA and TCE.
- A 1,1,1-TCA source possibly exists in the plating shop (in the MW360-2 vicinity). Additional groundwater evaluation is needed to the west and south to evaluate the extent of 1,1,1-TCA and in the area between Sites 7B and 11. This area is in this vicinity where the Holocene Bay Mud layer begins, and there is a potential for downward migration into the lower water-bearing zone.

Site 5

- The nature and extent of potential chemicals of interest in soils at Site 5 appears to have been adequately evaluated for the purpose of completing an RI/FS. No further soil sampling is recommended.
- A 1,1,1-TCA source may exist on the east side of Building 5, in the vicinity of M05-07. Based on the groundwater flow direction established during the first quarter of groundwater sampling (groundwater in the first water-bearing zone flows toward the northeast, east, and southeast from M05-07), and utilizing shallow monitoring wells from Sites 8 and 12, the extent of 1,1,1-TCA in groundwater has been adequately characterized toward the east and southeast. The extent of TCE in the

groundwater requires further assessment toward the northeast of M05-07. Additional HydroPunch samples and soil samples are recommended to the northeast of M05-07 in the first water-bearing zone, and northeast of Site 5 (in the vicinity of NPS-S5-04) in the first and second water-bearing zones. Discrete soil and groundwater samples are also recommended at this site to assess the potential for downward migration of the more dense TCE as a separate chemical phase.

Site 8

- The nature and extent of potential chemicals of interest in soils at Site 8 appears to have been adequately evaluated for the purpose of conducting an RI/FS. No further soil sampling is recommended at Site 8. If a human or environmental health risk exists, the need for further investigation will be evaluated.
- The extent of potential chemicals of interest in the groundwater in first and second water-bearing zones has been adequately characterized for the purpose of conducting an RI/FS. No additional groundwater monitoring wells are recommended.

Sites 10A and 12

- The extent of potential chemicals of interest in the soil and groundwater in first and second water-bearing zones has been adequately characterized for the purpose of conducting an RI/FS. No further soil or additional groundwater monitoring wells are recommended.

Site 14

- The nature and extent of potential chemicals of interest in soils at Site 14 appears to have been adequately characterized for the purpose of conducting an RI/FS. Although elevated concentrations of dioxins were found, it is recommended that the results be evaluated by toxicologists before additional sampling recommendations are made. If a human or environmental health risk exists, the need for further investigation will be evaluated.
- The extent of potential chemicals of interest in the groundwater in first and second water-bearing zones appears adequately assessed for the purpose of conducting an RI/FS. No additional groundwater monitoring wells are recommended.

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FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DATA TRANSMITTAL MEMORANDUM
SITES 4, 5, 8, 10A, 12, AND 14

DATED 01 APRIL 1996

THIS RECORD CONTAINS MULTIPLE VOLUMES
WHICH HAVE BEEN ENTERED SEPARATELY

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